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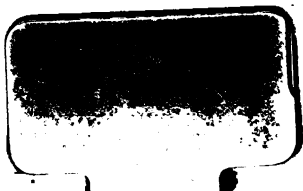
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ARITHMETICAL EXAMPLES

FOR

HOME AND SCHOOL USE.

NOTICE.

New Editions of the KEYS to DAVIS'S ARITHMETICAL EXAMPLES, Parts I. and II., are in preparation, bringing up the Answers to the New Editions of the "Examples." Meantime, the Answers to Fractions, Decimals, and Practice will, as heretofore, be found in the "Key to Part II.," and the Answers to the *new* matter in Part II. may be had gratuitously on application to Messrs. LONGMAN and Co.

LONDON, *July*, 1864.

SIXTEENTH THOUSAND.

REVISED AND GREATLY EXTENDED.

LONDON: LONGMAN & CO.—EDINBURGH: OLIVER & BOYD.
DUBLIN: J. ROBERTSON & CO.—MELBOURNE: G. ROBERTSON.

1864.



ARITHMETICAL EXAMPLES

FOR

HOME AND SCHOOL USE.

PART II.

CONTAINING NEARLY 2,000 QUESTIONS IN THE HIGHER
RULES OF ARITHMETIC, AND THE MORE USEFUL
RULES OF MENSURATION.

BY

WILLIAM DAVIS, B.A.

SIXTEENTH THOUSAND.

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LONDON: LONGMAN & CO.—EDINBURGH: OLIVER & BOYD.
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1864.

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ARITHMETICAL EXAMPLES.

PART II.

TARE AND TRET.

Find the tare on :—

- 1.—2 tons 5 cwt. 1 qr. gross, tare 14 lbs. per cwt.
- 2.—1 ton 5 cwt. 0 qr. 21 lbs. gross, tare 18 lbs. per cwt.
- 3.—4 bags, each 9 cwt. 24 lbs. gross, tare 1 qr. 16 lbs. per bag.
- 4.—88 boxes, each 1 cwt. 3 qrs. 19 lbs. gross, tare 4 lbs. per cwt.

Find the entire allowances on :—

- 5.—8 casks, each 2 cwt. 2 qrs. gross, tare 8 lbs. per cask, tret 4 lbs. in 104.
- 6.—14 barrels, weighing 1 ton 5 cwt. gross, tare 4 lbs. per cwt., tret 4 lbs. in 104.
- 7.—28 casks each weighing 3 cwt. 1 qr. gross, tare 15 lbs. per cask, tret 4 lbs. in 104
- 8.—72 packages, each 1 cwt. 1 qr. 5 lbs. gross, tare 8 lbs. per cwt., tret 4 lbs. in 104

Find the net weight of :—

- 9.—9 packages, each 15 cwt. 2 qrs. 10 lbs. gross, tare 5 lbs. per cwt.
- 10.—2 loads, each 57 cwt. 3 qrs. 9 lbs. gross, tare 1 qr. 4 lbs. per cwt.
- 11.—32 barrels, each 4 cwt. 1 qr. 14 lbs. gross, tare 1 qr. 8 lbs. per barrel.
- 12.—13 boxes, each 9 cwt. 24 lbs. gross, tare 18 lbs. per cwt.
- 13.—64 hhds., each 1 cwt. 2 qrs. 6 lbs. gross, tare $7\frac{1}{2}$ lbs. per hhd.
- 14.—3 barrels, each 2 cwt. 0 qr. 20 lbs. gross, tare per barrel 29 lbs.
- 15.—18 packages, each 9 cwt. 1 qr. 2 lbs. gross, tare 1 qr. 22 lbs. per package.
- 16.—27 boxes, each 6 cwt. 20 lbs. gross, tare 1 qr. 22 lbs. per box.
- 17.—68 casks, each 3 cwt. 3 qrs. 14 lbs. gross, tare 1 qr. 6 lbs. per cask.
- 18.—7 tons 5 cwt. 0 qr. 24 lbs. gross, tare 8 lbs. per cwt., tret 4 lbs. in 104.
- 19.—1 ton 19 cwt. 1 qr. 13 lbs. gross, tare 8 lbs. per cwt.
- 20.—5 tons 4 cwt. 1 qr. 4 lbs. gross, tare 14 lbs. per cwt., tret allowed.
- 21.—1 ton 1 cwt. 1 qr. $16\frac{1}{2}$ lbs. gross, tare $17\frac{1}{2}$ lbs. per cwt., tret allowed.
- 22.—3 tons 17 cwt. 1 qr. 11 lbs. gross, tare 18 lbs. per cwt., tret allowed.
- 23.—7 casks, each $1\frac{1}{2}$ tons gross, tare per cask 3 qrs. $7\frac{1}{2}$ lbs., tret allowed.
- 24.—9 loads of coals, each $2\frac{3}{4}$ tons gross, tare per load 5 cwt. 1 qr. 5 lb.
- 25.—9 bags of sugar, each $5\frac{3}{4}$ cwt. gross, tare 8 lbs. per cwt., tret allowed.
- 26.—5 casks of treacle, each 19 cwt. gross, tare $\frac{1}{3}$ of the whole, tret allowed.
- 27.—18 tons 5 cwt. of molasses, tare 18 lbs. per cwt., tret allowed.
- 28.—5 tons 3 cwt. 1 qr. 5 lbs. of butter, tare 59 lbs. per ton, tret allowed.
- 29.—3 casks, each $1\frac{1}{2}$ tons gross, tare $15\frac{1}{2}$ lbs. per cwt., tret allowed.
- 30.—24 butts, each $1\frac{1}{2}$ tons gross, tare $19\frac{1}{2}$ lbs. per butt, tret allowed.

SIMPLE INTEREST.

CASE 1.—*Find the interest on :—*

	£	s.	d.	yrs.				
1.	60	6	8	for 1	at 5;	at 6;	and at 4	per cent.
2.	180	3	4	" 1	" 3;	" 2;	" 1	"
3.	240	10	0	" 1	" 5;	" 7;	" 4	"
4.	850	10	0	" 1	" 5;	" 3;	" 2	"
5.	390	12	6	" 1	" 4;	" 6;	" 1	"
6.	4500	0	0	" 1	" 3;	" 5;	" 4	"
7.	780	5	0	" 3	" 5;	" 2;	" 4	"
8.	1680	15	0	" 5	" 3;	" 7;	" 5	"
9.	4900	0	0	" 3	" 5½;	and for 2 yrs. at 4 per cent		
10.	27185	15	6	" 4½	" 4½;	" 3½	" 2½	"
11.	650	12	0	" 3½	" 3½;	" 2½	" 4½	"
12.	638	1	0	" 5½	" 3½;	" 4	" 1½	"
13.	4850	0	0	" 4	" 4½;	" 3¼	" 2½	"
14.	815	15	6	" 5½	" 3½;	" 5	" 2½	"
15.	2056	10	0	" 7	" 4½;	" 3	" 5½	"

CASE 2.—*Find the interest on :—*

	£	s.	d.	yrs.	mo.	p.c.	yrs.	mo.	p.c.
1.	500	0	0	for 2	3	at 5;	and for 3	2	at 4½
2.	300	0	0	" 5	9	" 3½;	" 4	1	" 2½
3.	120	10	0	" 2	6	" 4½;	" 3	5	" 3¼
4.	425	13	6	" 2	10	" 6¼;	" 7	8	" 4½
5.	3107	18	6¾	" 3	11	" 4½;	" 5	7	" 5½
6.	767	2	3	" 6	7	" 7;	" 2	10	" 4¾
7.	659	2	6	" 5	11	" 3½;	" 6	1	" 2½
8.	9104	15	3	" 2	3	" 6;	" 4	2	" 3½
9.	526	9	9	" 7	1	" 2½;	" 3	11	" 5½
10.	217	5	2¾	" 3	8	" 2¾;	" 7	5	" 3¼
11.	395	7	8	" 4	10	" 4;	" 6	7	" 6½
12.	217	5	2¾	" 1	11	" 2¾;	" 4	5	" 3½
13.	2082	7	11	" 1	10	" 3½;	" 2	7	" 4½
14.	1442	16	10	" 2	9	" 3½;	" 9	2	" 5½
15.	212	10	4	" 2	9	" 1½;	" 7	7	" 3½
	£	s.	d.	yrs.	wks.	p.c.	yrs.	wks.	p.c.
16.	400	0	0	for 2	1	at 5;	and for 3	5	at 3½
17.	256	5	3	" 0	25	" 2½;	" 4	17	" 4½
18.	7560	14	2	" 3	19	" 4½;	" 5	39	" 5½
19.	785	16	4	" 7	12	" 4½;	" 6	13	" 3½
20.	8540	13	9	" 0	37	" 5½;	" 1	50	" 4¾
"	921	12	2	" 4	40	" 4½;	" 8	32	" 6½

				yrs. d.				yrs. d.	p.c.
22.	7354	15	6	for 4 135	at $3\frac{1}{4}$;	and for 3 115	at $2\frac{1}{8}$		
23.	3619	11	9	" 2 217	" $4\frac{1}{4}$;	" 5 120	" 3		
24.	1068	0	$1\frac{1}{2}$	" 0 79	" 3;	" 2 340	" $5\frac{1}{4}$		
25.	120	0	0	" 3 126	" 4;	" 1 229	" $3\frac{1}{2}$		
26.	2768	0	0	" 0 96	" $1\frac{1}{2}$;	" 4 118	" $1\frac{1}{2}$		
27.	5000	0	0	" 0 73	" $4\frac{3}{4}$;	" 7 14	" $4\frac{7}{8}$		
28.	7138	18	4	" 3 158	" $3\frac{1}{4}$;	" 2 19	" $5\frac{1}{4}$		
29.	891	0	0	" 1 255	" $4\frac{3}{8}$;	" 6 116	" $2\frac{1}{2}$		
30.	584	0	0	" 6 50	" $5\frac{1}{8}$;	" 3 98	" $4\frac{1}{8}$		

CASE 3.—Find the amount of:—

				yrs.	p.c.		yrs.	
1.	500	0	0	for 9	at 5;	and for 3	at $3\frac{1}{2}$	per cent.
2.	420	0	0	" 8	" 3;	" 5	" $2\frac{1}{2}$	"
3.	690	0	0	" 3	" $4\frac{1}{4}$;	" 8	" $4\frac{1}{2}$	"
4.	300	0	0	" $5\frac{3}{4}$	" $3\frac{1}{4}$;	" $6\frac{1}{2}$	" $5\frac{3}{4}$	"
5.	1110	18	0	" $12\frac{3}{4}$	" 5;	" $5\frac{1}{2}$	" $2\frac{1}{2}$	"
6.	508	14	0	" 1	" $2\frac{1}{2}$;	" 9	" $1\frac{1}{4}$	"
7.	567	8	$9\frac{3}{4}$	" 3	" $2\frac{7}{8}$;	" $4\frac{1}{2}$	" 4	"
8.	737	12	0	" $7\frac{3}{4}$	" $6\frac{1}{2}$;	" 5	" $2\frac{3}{8}$	"
9.	397	9	5	" $2\frac{1}{2}$	" $3\frac{1}{2}$;	" $7\frac{1}{2}$	" $3\frac{3}{4}$	"
10.	2171	12	6	" $4\frac{1}{2}$	" $2\frac{1}{2}$;	" 5	" $2\frac{7}{8}$	"
11.	730	13	4	" $4\frac{1}{2}$	" $5\frac{7}{8}$;	" $3\frac{1}{4}$	" 4	"

				yrs. mo.	p.c.		yrs. mo.	p.c.
12.	2980	15	0	" 0 7	at $5\frac{3}{4}$;	and for 2 2	at $3\frac{1}{4}$	
13.	735	16	9	" 5 6	" $3\frac{1}{8}$;	" 3 7	" $4\frac{1}{2}$	
14.	875	13	6	" 9 2	" 5;	" 0 11	" 3	
15.	672	0	0	" 2 1	" $7\frac{1}{2}$;	" 3 5	" $6\frac{3}{4}$	
16.	1760	0	0	" 2 5	" 5;	" 4 10	" 3	
17.	845	12	4	" 5 7	" $2\frac{5}{8}$;	" 7 4	" $4\frac{1}{8}$	

	£	s.	d.	yrs. wks.	p.c.		yrs. wks.	p.c.
18.	785	19	6	for 2 13	at $4\frac{1}{2}$;	and for 3 24	at $5\frac{1}{2}$	
19.	989	13	6	" 4 19	" $3\frac{3}{8}$;	" 5 16	" $4\frac{1}{4}$	
20.	4750	12	4	" 5 36	" 4;	" 4 40	" 5	
21.	934	18	2	" 0 15	" $7\frac{3}{4}$;	" 1 46	" $2\frac{3}{4}$	
22.	87	19	10	" 1 25	" 2;	" 0 50	" $3\frac{1}{8}$	
23.	473	12	5	" 2 39	" $3\frac{7}{8}$;	" 2 10	" $4\frac{1}{8}$	

				yrs. d.			yrs. d.	
24.	280	10	0	" 3 148	" 5;	" 2 120	" $5\frac{1}{2}$	
25.	700	0	0	" 4 73	" 5;	" 1 169	" $4\frac{1}{4}$	
26.	1091	4	0	" 0 325	" $5\frac{1}{2}$;	" 6 340	" $2\frac{1}{2}$	
27.	730	0	0	" 0 90	" $2\frac{1}{2}$;	" 0 64	" $3\frac{1}{4}$	

			yrs.	d.			yrs.	d.	
28.	5764	12	4	for 3 190	„	$3\frac{3}{8}$	; and for 1 178	„	$4\frac{2}{3}$
29.	859	13	7	„ 2 15	„	$5\frac{1}{8}$	„ 0 200	„	5
30.	498	19	4	„ 1 279	„	$2\frac{5}{8}$	„ 2 69	„	$3\frac{1}{5}$

31. What is the interest on £120 from February 7th to October 13th, at 4 per cent. ?

32. What is the interest on £350 from March 14th to December 1st, at $3\frac{1}{2}$ per cent. ?

33. What will £1,287 13s. amount to from March 23rd to August 18th, at $4\frac{1}{2}$ per cent. ?

34. What will £1,931 9s. 6d. amount to from April 18th to October 19th, at $3\frac{1}{2}$ per cent. ?

35. What is the interest on £14,277 16s. 8d. from June 1st to November 6th, at $3\frac{1}{4}$ per cent. ?

36. What is the interest on £10 from the 3rd to the 28th of March, at $2\frac{1}{2}$ per cent. ?

37. What will £1,633 15 1 $\frac{1}{2}$ d. amount to from January 4th to April 17th, 1862, at $4\frac{3}{8}$ per cent. ?

38. Find the amount on £763 5s. from April 7th to December 9th, at $4\frac{1}{2}$ per cent. ?

39. What is the interest on £100 from June 1st, 1859, to March 9th, 1860, at 5 per cent. ?

40. Find the interest on £1,028 17s. from April 13th to May 28th, at 5 per cent. ?

CASE 4.—*What sum will amount to :—*

	£	s.	d.	yrs.		£	s.	d.	yrs.	p.c.
1.	367	4	0	in 9; and to	540	0	0	in 5	at 4	
2.	777	19	6	„ 3; „	105	6	0	„ $3\frac{1}{2}$	„ $4\frac{1}{4}$	
3.	9144	4	$4\frac{1}{2}$	„ 2; „	968	16	0	„ $3\frac{1}{4}$	„ $3\frac{1}{2}$	
4.	777	0	0	„ $2\frac{1}{12}$; „	797	9	7	„ $3\frac{1}{2}$	„ $7\frac{1}{2}$	
5.	312	4	$3\frac{7}{100}$	„ 7; „	1022	13	$1\frac{1}{2}$	„ $4\frac{1}{2}$	„ $3\frac{1}{4}$	
6.	3493	7	$7\frac{3}{4}\frac{409}{1000}$	„ $9\frac{1}{4}$; „	779	19	$0\frac{3}{10}$	„ $3\frac{1}{4}$	„ $3\frac{1}{4}$	
7.	549	17	6	„ $5\frac{3}{4}$; „	849	12	4	„ $6\frac{1}{6}$	„ $4\frac{1}{8}$	
8.	899	14	9	„ $7\frac{3}{4}$; „	1040	15	9	„ $1\frac{1}{8}$	„ $5\frac{1}{2}$	
9.	7340	10	6	„ $2\frac{1}{4}$; „	6380	12	4	„ $4\frac{3}{4}$	„ $1\frac{5}{8}$	
10.	958	13	7	„ $5\frac{1}{2}$; „	784	13	2	„ $6\frac{1}{2}$	„ $4\frac{3}{7}$	

CASE 5.—*At what rate per cent will :—*

1. £500 amount to £725 in 9 years ?
2. 300 amount to £375 in 5 years ?
3. 360 amount to £460 16s. in 7 years ?
4. 368 amount to £447 9s. $9\frac{3}{4}$ d. in 6 years ?
5. 633 amount to £664 13s. in $1\frac{1}{2}$ years ?

6. £625 15s. amount to £680 10s. 0 $\frac{1}{4}$ d. in 3 $\frac{1}{2}$ years?
7. 175l 9s. 2 $\frac{1}{2}$ d. amount to £2498 0s. 4 $\frac{3}{4}$ d. $\frac{1}{10}$ in 11 years?
8. 152 10s. amount to £191 7s. 9d. in 6 years?
9. 450 amount to £463 10s. in 292 days?
10. 376 13s. 4d. amount to £565 in 15 years?

CASE 6.—*In what time will :—*

1. £560 10s. amount to £630 11s. 3d., at 2 $\frac{1}{2}$ per cent.?
2. 375 8s. 4d. amount to £408 5s. 3 $\frac{3}{4}$ d., at 2 $\frac{1}{2}$ per cent.?
3. 196 amount to £200 1s. 2 $\frac{1}{2}$ d. at 4 per cent.?
4. 125 amount to £250, at 7 $\frac{1}{2}$ d. per cent.?
5. 723 17s. 6d. amount to £805 6s. 2 $\frac{1}{2}$ d. $\frac{1}{2}$, at 2 $\frac{1}{2}$ per cent.?
6. 193 11s. 3d. amount to £226 17s. 7 $\frac{1}{2}$ d. $\frac{1}{3}$ at 4 $\frac{1}{2}$ per cent.?
7. 187 16s. 10d. amount to £191 7s. 3 $\frac{1}{4}$ d. $\frac{3}{10}$, at 4 $\frac{1}{2}$ per cent.?
8. 1,043 15s. amount to £1,165 10s. 5d., at 5 $\frac{1}{2}$ per cent.?
9. 2,190 amount to £2,893 5s. 9 $\frac{3}{4}$ d., at 3 $\frac{1}{2}$ per cent.?
10. 2,980 15s. amount to £3,080 14s. 7 $\frac{3}{8}$ d., at 5 $\frac{1}{4}$ per cent.?

COMPOUND INTEREST.*

Find the compound interest and the amount (at compound interest) of :—

£	s.	d.	yrs.	p.c.	£	s.	d.	yrs.	p.c.
1.	250	0 0	for 3	at 5	11.	320	10 0	for 4	at 5
2.	850	0 0	" 4	" 3	12.	150	0 0	" 3	" 2 $\frac{3}{4}$
3.	795	0 0	" 5	" 5	13.	372	0 0	" 7	" 5
4.	600	0 0	" 3	" 5	14.	1785	13 8	" 3 $\frac{3}{4}$	" 4 $\frac{1}{4}$
5.	1250	10 0	" 2 $\frac{1}{2}$	" 4	15.	9250	15 6	" 4 $\frac{1}{4}$	" 3 $\frac{1}{2}$
6.	1846	12 6	" 3 $\frac{1}{2}$	" 2	16.	160	0 0	" 4	" 6
7.	954	13 9	" 4	" 3 $\frac{1}{2}$	17.	765	10 0	" 5 $\frac{1}{2}$	" 4
8.	150	0 0	" 5	" 4	18.	1650	0 0	" 3	" 5
9.	863	10 0	" 4 $\frac{1}{2}$	" 5	19.	1747	2 6	" 5	" 5 $\frac{1}{2}$
10.	346	10 0	" 6 $\frac{1}{2}$	" 4 $\frac{1}{2}$	20.	2960	0 0	" 6	" 4

* In order that the answers to the compound interest sums may agree with those of the Key the pupil is recommended to work the sums by rule, paragraph 79, "Memory Work."

21. What will £750 amount to, at compound interest, in 3 years, at $2\frac{1}{2}$ per cent., the interest being payable half-yearly?

22. What will £875 amount to, in 2 years, at 5 per cent., the interest being payable quarterly?

23. What is the difference between the amount at simple interest, and the amount at compound interest, of £640, for 4 years, at 5 per cent.?

24. What will £788 16s. $0\frac{1}{4}$ d. amount to, in $2\frac{1}{2}$ years, at 3 per cent., the interest being payable quarterly?

25. Find the compound interest on £760 15s. for 2 years, payable half-yearly, at 4 per cent. per annum?

26. What will £1600 amount to, in 5 years, at 4 per cent., the interest being payable quarterly?

27. What will £793 0s. $2\frac{1}{4}$ d. amount to, in $4\frac{1}{2}$ years, at 3 per cent., the interest being payable half-yearly?

28. What will £1230 amount to, in $2\frac{1}{2}$ years, at $4\frac{1}{2}$ per cent., the interest being payable quarterly?

29. What is the compound interest on £2870, for $2\frac{1}{2}$ years, at $4\frac{1}{2}$ per cent., the interest being payable half-yearly?

30. What will £290 3s. $3\frac{3}{4}$ d. amount to, in 3 years, at $2\frac{1}{2}$ per cent., the interest being payable yearly?

31. Find the difference between the simple and compound interest on £500, for 3 years, at 5 per cent.

32. What will £875 15s. 6d. amount to, in 3 years 7 months, at $3\frac{1}{2}$ per cent.?

33. What is the compound interest on £1380 17s. 4d., for 4 years 6 months 3 weeks, at $2\frac{1}{2}$ per cent.?

34. What will £15,640 12s. 6d. amount to, in $3\frac{1}{4}$ years, at $4\frac{1}{2}$ per cent.?

What sum, lent at compound interest, will amount to—

	£	s.	d.	yrs.	p.c.		£	s.	d.	yrs.	p.c.
35.	178	8	$0\frac{1}{2}$	in 5	at 4	43.	100	0	0	in 6	at $4\frac{1}{2}$
36.	145	17	2	" 4	" 5	44.	57	13	$9\frac{1}{2}$	" 15	" 5
37.	251	5	$5\frac{1}{2}\frac{69}{100}$	" 3	" $3\frac{3}{4}$	45.	1616	15	$11\frac{3}{4}$	" 13	" 4
38.	1169	17	$2\frac{3}{4}\frac{4}{5}$	" 3	" 4	46.	76	3	5	" 7	" 5
39.	1184	3	$10\frac{1}{4}$	" 10	" 4	47.	155	14	2	" 3	" $2\frac{1}{2}$
40.	972	8	$1\frac{3}{4}$	" 4	" 5	48.	1585	17	$4\frac{1}{4}$	" 25	" $4\frac{1}{2}$
41.	461	7	6	" $6\frac{1}{2}$	" $4\frac{1}{2}$	49.	230	15	$2\frac{3}{4}$	" 15	" 5
42.	1130	13	$4\frac{1}{4}$	" 20	" 5	50.	116	8	$3\frac{69045}{1000000}$	" 3	" $3\frac{1}{2}$

What is the commission, brokerage, or premium of insurance on each of the following sums :—

	£	s.	d.		pr.ct.		£	s.	d.		pr.ct.
1.	254	0	0	at	$\frac{1}{8}$	40.	6332	0	0	at	$1\frac{1}{8}$
2.	279	0	0	"	$\frac{1}{8}$	41.	299	0	0	"	$\frac{1}{8}$
3.	323	0	0	"	$\frac{1}{8}$	42.	280	0	0	"	1
4.	1264	6	0	"	$\frac{1}{4}$	43.	172	10	0	"	$1\frac{1}{4}$
5.	286	0	0	"	$\frac{1}{4}$	44.	357	0	0	"	$2\frac{1}{4}$
6.	329	0	0	"	$\frac{1}{4}$	45.	137	0	0	"	$\frac{1}{2}$
7.	358	0	0	"	$\frac{1}{4}$	46.	225	6	8	"	$1\frac{1}{2}$
8.	6352	0	0	"	$\frac{1}{4}$	47.	364	10	0	"	2
9.	213	0	0	"	$\frac{3}{8}$	48.	348	5	0	"	$2\frac{1}{4}$
10.	10340	0	0	"	$\frac{3}{4}$	49.	1362	0	0	"	1
11.	5331	5	0	"	1	50.	278	10	0	"	$1\frac{1}{4}$
12.	115	0	0	"	$1\frac{1}{2}$	51.	1363	0	0	"	$2\frac{1}{2}$
13.	526	0	0	"	$1\frac{3}{4}$	52.	935	0	0	"	$\frac{7}{8}$
14.	332	0	0	"	$1\frac{3}{4}$	53.	1365	0	0	"	2
15.	765	0	0	"	$2\frac{1}{4}$	54.	333	0	0	"	$1\frac{3}{4}$
16.	135	10	0	"	2	55.	5330	0	0	"	3
17.	179	0	0	"	$2\frac{1}{4}$	56.	8329	0	0	"	$\frac{7}{8}$
18.	733	0	0	"	$\frac{3}{8}$	57.	361	5	0	"	$3\frac{1}{2}$
19.	7308	0	0	"	$2\frac{1}{2}$	58.	2328	0	0	"	$\frac{3}{4}$
20.	364	0	0	"	$1\frac{3}{4}$	59.	9330	0	0	"	$2\frac{1}{2}$
21.	288	0	0	"	1	60.	701	5	0	"	$\frac{7}{8}$
22.	331	10	0	"	$2\frac{1}{2}$	61.	175	10	0	"	3 10 0
23.	830	0	0	"	$2\frac{1}{2}$	62.	130	10	0	"	0 5 0
24.	8014	0	0	"	$\frac{1}{8}$	63.	359	5	0	"	3 10 0
25.	284	0	0	"	$2\frac{1}{2}$	64.	1750	0	0	"	0 13 4
26.	5025	0	0	"	3	65.	732	15	3	"	0 6 9
27.	172	15	0	"	$1\frac{1}{2}$	66.	865	0	0	"	0 2 6
28.	195	10	0	"	3	67.	4100	0	0	"	0 14 6
29.	1233	0	0	"	3	68.	183	0	0	"	0 10 10
30.	364	0	0	"	$\frac{5}{8}$	69.	121	0	0	"	4 0 0
31.	349	0	0	"	$\frac{1}{2}$	70.	524	5	0	"	0 10 3
32.	1318	0	0	"	$\frac{1}{2}$	71.	7329	0	0	"	0 5 0
33.	71	0	0	"	$\frac{1}{2}$	72.	875	0	0	"	1 2 4
34.	324	0	0	"	$\frac{3}{8}$	73.	266	5	0	"	5 0 0
35.	356	0	0	"	1	74.	845	9	4	"	1 8 4
36.	265	5	0	"	$1\frac{1}{2}$	75.	2045	6	3	"	0 15 3
37.	229	10	0	"	2	76.	277	0	0	"	4 0 0
38.	6196	0	0	"	$\frac{7}{8}$	77.	237	0	0	"	9 9 7
39.	286	5	0	"	$2\frac{1}{4}$	78.	502	13	0	"	0 13 6

	£	s.	d.	per cent.		£	s.	d.	per cent.
79.	1712	10	0	at £0 3 9	90.	240	0	0	at £0 7 6
80.	329	0	0	" 0 7 6	91.	1420	0	0	" 0 16 8
81.	755	13	4	" 0 8 4	92.	2405	0	0	" 1 2 9
82.	925	0	0	" 0 4 2	93.	931	0	0	" 5 0 0
83.	332	0	0	" 4 0 0	94.	179	0	0	" 4 10 0
84.	1081	0	0	" 1 7 3	95.	353	0	0	" 0 7 6
85.	765	0	0	" 0 7 6	96.	326	0	0	" 0 10 0
86.	931	3	6	" 0 11 9	97.	292	5	0	" 0 5 0
87.	132	10	0	" 4 10 0	98.	1421	12	6	" 0 7 3
88.	470	1	8	" 0 15 9	99.	867	5	0	" 0 18 4
89.	4355	12	0	" 0 5 4	100.	4332	0	0	" 0 2 6

101. What will the insurance of £576 10s. 6d. worth of furniture cost, the premium being $\frac{3}{8}$ per cent., and the duty 3s. per cent. ?

102. What will be a broker's charges for purchasing goods to the amount of £576, at 11s. 3d. per cent. ?

103. What will a commission agent earn by purchasing 3,000 barrels of American flour, at £1 15s. 0d. per barrel, at a commission of 5s. 4d. per cent. ?

104. What is the total annual premium on the following insurances :—£500 on furniture, at 1s. 6d. per cent. ; £100 on pictures, at 10s. per cent. ; £50 on tools and miscellaneous articles, at 7s. 6d. per cent., and the duty on the whole 3s. per cent. ?

105. What will the premiums on a £1,000 life policy amount to, net, in five years, if the rate is £2 14s. per cent. per annum, but at the end of the 5 years 20 per cent. of the premiums be returned as a bonus ?

106. What must a broker receive for buying goods to the amount of £1,560 4s. 8d., his brokerage being charged at 3s. 4d. per cent., with 1s. 4d. per cent. added for incidental charges ?

107. If the annual premiums of a life policy for £2,000, at £2 18s. per cent., be paid for 50 years, a return of 20 per cent. on the premiums being made every 5 years, what will be the net payments in the whole time ?

108. If I insured property worth £1,345 10s. at 2s. 8d. per cent., and find, after a time, I have paid £14 7s. 0 $\frac{1}{2}$ d., how many years' premiums have I paid ?

109. What sum paid in premiums will secure property worth £874 10s. for 5 years, the annual premium being at $\frac{1}{4}$ per cent. on the value ?

110. What is the annual premium on £950, at £3 1s. 6d. cent. ?

111. What sum must be paid in annual premiums, at 5s. 9d. per cent., to recover three-fourths of the value of a house rented at £20 a year, and of a value equal to thirty times the rent?

112. A building worth £3,000 is insured to $\frac{3}{4}$ its value by an annual premium of 4s. 6d. per cent. on the $\frac{3}{4}$, with 3s. per cent. duty, and after 4 annual payments it is burnt down completely. What will be the insurer's absolute loss, including his annual payments?

113. What will it cost to insure a ship worth £25,000 during war, the underwriter's ordinary charge being at the rate of $3\frac{1}{2}$ per cent., but the war risk increasing it ten fold?

114. An agent charges £3 5s. 6d. per cent. commission, taking the risk of bad debts. After doing business to the extent of £20,000, and losing £150 in bad debts, what has he to receive?

115. What will a traveller make in a year if he does business to the amount of £350 weekly, at a commission of 4 per cent., his expenses averaging 15s. 9d. each day, Sundays excepted?

116. A Newgate Market salesman sells 80 bullocks, averaging 70 stones (of 8 lb.), at 5d. per lb., and 500 sheep, averaging 30 lbs. per quarter, at $4\frac{3}{4}$ d. per lb. What will his commission amount to at $\frac{1}{8}$ per cent.?

STOCKS.

Find what sums will purchase:—

1. £720 stock at 84	9. £344 stock at $81\frac{3}{4}$
2. £879 " 76	10. £647 " $99\frac{3}{4}$
3. £542 " 84	11. 850 £100 shares at 5 p. c. dis.
4. £863 " 91	12. 414 £120 " 4 p. c. pre.
5. £546 " 99	13. 327 £50 " 2 p. c. dis.
6. £916 " $84\frac{1}{2}$	14. 649 £10 " 5 p. c. pre.
7. £731 " $96\frac{3}{4}$	15. 978 £1 " 8 p. c. dis.
8. £928 " $95\frac{7}{8}$	

Find what per centage will be realised by purchasing:

16. £3 per ct. at 84 per ct.	20. £4 per ct. at 91 per ct.
17. £4 " 92 "	21. £3 $\frac{1}{4}$ " 79 "
18. £5 " 93 "	22. £5 $\frac{1}{2}$ " 89 "
19. £3 " 86 "	23. £4 " 83 "

24. £3 $\frac{1}{2}$ per ct. at 75 per ct.	28. £3 $\frac{3}{4}$ per ct. at 81 per ct.
25. £3 $\frac{1}{2}$ " 80 "	29. £4 $\frac{1}{4}$ " 92 "
26. £2 $\frac{1}{2}$ " 73 "	30. £3 $\frac{1}{2}$ " 78 "
27. £3 $\frac{1}{2}$ " 77 "	

Find what annual return will be realised by investing the following sums in the kind of stock mentioned and at the prices named:—

per cent. stock	per cent. stock
31. £784 in the 3 at 84	36. £6917 in the 4 at 90
32. £1291 " 3 $\frac{1}{2}$ " 89	37. £5416 " 3 $\frac{1}{2}$ " 87
33. £8594 " 4 " 92	38. £697 " 3 $\frac{3}{4}$ " 88
34. £619 " 2 $\frac{3}{4}$ " 81	39. £5976 " 4 $\frac{1}{4}$ " 93
35. £5964 " 3 $\frac{1}{4}$ " 87	40. £6728 " 4 $\frac{1}{2}$ " 96

Find what sums must be invested in the following kinds of stock, and at the prices named, to produce the annual income stated:—

p.c. stock	income.	p.c. stock.	income.
41. 4 at 89 to produce £79		46. 5 at 96 to produce £80	
42. 3 " 78 " £124		47. 4 $\frac{1}{2}$ " 89 " £70	
43. 3 $\frac{1}{2}$ " 81 " £130		48. 4 $\frac{3}{4}$ " 92 " £120	
44. 4 $\frac{1}{2}$ " 91 " £70		49. 3 $\frac{3}{4}$ " 89 " £150	
45. 2 $\frac{3}{4}$ " 73 " £90		50. 3 $\frac{1}{4}$ " 87 " £120	

51. What will be gained by purchasing 800 £10 shares at $\frac{1}{8}$ per cent. discount, and selling them at $\frac{1}{4}$ per cent. premium?

52. How much will be gained by purchasing 10 £20 bank shares for £250, and selling them at a rise of $\frac{7}{8}$ per cent., after receiving dividends at the rate of 3 per cent. on the original shares?

53. A capitalist pays his Christmas bills, amounting to £964, by the profits of dealings in Consols, the stock having risen $\frac{1}{16}$ per cent. while in his hands. How much money did he invest?

54. A joint stock bank, with a paid-up capital of half a million in £50 shares, makes a profit of 9 per cent.; how many shares would produce an income of £350 a year after paying 2 per cent. property tax?

55. By investing in 4 $\frac{1}{2}$ per cent. stock at 94 I realise an income of £83 5s. per annum: what sum did I invest?

56. What is the value of a legacy of £4964 in 4 per cent. stock selling at 93, after deducting legacy duty 3 $\frac{1}{2}$ per cent?

57. By purchasing at 10 per cent. discount and selling at 4 per cent. premium £300 were cleared. What sum was invested?

58. If 3 per cent. stock is bought to pay 5 per cent. what rate is given for it?

59. A company, with a subscribed capital of 5000 shares, £10 paid, after paying expenses of management £950, and income tax at 9d. in the pound, divides 5 per cent. to the shareholders: what were the gross returns?

60. If a person transfers £5000 from 3 per cent. stock at 74, to 4 per cent. stock at 75, what does he gain per cent.?

DISCOUNT.

Find the discount and present worth of each of the following sums for the time, and at the rate per annum, stated:—

	£	s.	d.	m.	p.c.		£	s.	d.	m.	p.c.
1.	120	0	0	due in 3	at 5	26.	278	8	10	due in 15	at 3½
2.	150	0	0	"	3 " 4	27.	833	6	8	"	11 " 5½
3.	250	0	0	"	4 " 6	28.	102	9	7	"	7 " 4½
4.	390	0	0	"	6 " 5	29.	1691	12	8	"	16 " 4½
5.	450	0	0	"	7 " 4	30.	578	6	8	"	11 " 5½
6.	940	0	0	"	8 " 3	31.	125	0	0	"	8 " 3½
7.	647	0	0	"	7 " 4					days.	
8.	450	0	0	"	6 " 5	32.	1000	0	0	"	285 " 5
9.	300	0	0	"	8 " 5	33.	300	0	0	"	33 " 5
10.	1158	15	6	"	3 " 4	34.	390	5	0	"	40 " 4
11.	150	0	0	"	3 " 5	35.	320	6	0	"	118 " 5
12.	630	2	6	"	3 " 2½	36.	85	10	0	"	67 " 5
13.	560	12	0	"	9 " 3½	37.	543	7	0	"	138 " 4½
14.	75	0	0	"	15 " 5	38.	60	0	0	"	70 " 5
15.	275	10	0	"	7 " 5	39.	133	10	0	"	14 " 5
16.	898	9	7	"	18 " 4½	40.	833	6	8	"	165 " 4
17.	540	0	0	"	14 " 3	41.	362	8	6	"	73 " 4
18.	500	0	0	"	17 " 3½	42.	927	3	8	"	313 " 4
19.	864	8	3	"	8 " 4½	43.	1020	0	0	"	120 " 3¾
20.	871	5	0	"	2 " 4½	44.	661	11	0	"	70 " 3¾
21.	96	18	4	"	7 " 5	45.	69	8	11	"	29 " 6¾
22.	357	10	0	"	9 " 5	46.	124	5	0	"	110 " 4½
23.	317	11	9	"	4 " 4¾	47.	1675	12	8	"	150 " 4
24.	1481	12	0	"	5 " 5½	48.	100	18	0¾	"	66 " 5
25.	102	18	4	"	7 " 5	49.	1117	16	0	"	106 " 5¾
						50.	722	10	0	"	120 " 5½

Find the banker's discount, and the true discount of each of the following bills :—

£	s.	d.	Drawn			Discounted	p.c.
51.	649	8	0	March 9	at 3 months,	April 4,	at 4
52.	357	6	0	January 4	" 6 "	Feb. 11	" 3
53.	642	0	0	February 11	" 6 "	April 4	" $3\frac{1}{2}$
54.	973	0	0	April 8	" 4 "	June 7	" 5
55.	375	0	0	January 4	" 3 "	February 9	" $4\frac{3}{4}$
56.	728	3	0	June 4	" 5 "	Sept. 8	" $5\frac{1}{4}$
57.	973	18	0	July 7	" 7 "	July 7	" $4\frac{1}{2}$
58.	847	16	0	September 8	6 "	Jan. 8	" $3\frac{7}{8}$
59.	728	0	0	January 11	" 12 "	May 4	" $4\frac{3}{4}$
60.	436	0	0	February 4	" 8 "	June 7	" $5\frac{1}{4}$

Find the banker's discount and present worth, and the true discount and present worth, on each of the two following sums :—

61. £840 due in two equal instalments at 3 months and 6 months, discounting at $3\frac{1}{2}$ per cent.

62. £934 payable in three equal sums at 3 months, 6 months, and 9 months, discounting at 4 per cent.

63. What is the banker's discount, and what the true discount on £964 payable in four equal instalments at 3, 6, 9, and 12 months, discounting at $3\frac{1}{2}$ per cent.?

64. What is the present worth of £968 payable in two moieties at 3 and 6 months, discounting at 4 per cent.?

65. What ready money will discharge a debt of £1594 10s. 8d. due 327 days hence, discounting at 6 per cent. per annum?

66. What would be the banker's discount from the day of drawing of three bills drawn January 4, one for £846 at 3 months, the second for £84 at 4 months, and the third for £1269 10s. for 6 months, discounting at 4 per cent. per annum?

EQUATION OF PAYMENTS.

Find a single time for making the payments in each of the following examples :—

£	s.	d.	mo.	£	s.	d.	mo.	£	s.	d.	mo.					
1.	94	0	0	at 3;	79	0	0	at 4;	49	0	0	at 2; and 698	0	0	at 9	
2.	26	0	0	" 5;	32	0	0	" 2;	28	0	0	" 4;	" 293	0	0	" 6
3.	34	6	8	" 11;	21	5	0	" 8;	24	6	0	" 5;	" 973	8	0	" 6
4.	68	3	9	" 9;	47	5	4	" 7;	26	9	8	" 5;	" 234	3	1	" 3
	96	8	"	" 3;	96	6	8	" 11;	28	8	9	" 8;	" 546	5	8	" 6
	" 15	9	"	" 7;	46	14	$3\frac{1}{2}$	" 6;	76	8	$5\frac{1}{2}$	" 4;	" 768	1	8	" 9

£	s.	d.		mo.	£	s.	d.		mo.	£	s.	d.		mo.	£	s.	d.	mo.			
7.	69	8	11	at	4;	37	11	8	at	5;	47	8	2½	at	6;	at	647	5	8	at	7
8.	97	19	9½	"	2;	58	16	3½	"	4;	39	1	1½	"	8;	"	168	2	3	"	2
9.	55	15	5½	"	1;	66	16	6½	"	2;	77	17	7½	"	3;	"	999	9	9	"	4
10.	78	14	9	"	3;	69	17	3	"	5;	54	11	8	"	2;	"	557	1	3	"	5

£	s.	d.		days.	£	s.	d.		days.	£	s.	d.		days.		
11.	854	11	6½	at	256;	596	18	3½	at	158;	and	824	16	11½	at	148
12.	351	16	11½	"	129;	728	16	8½	"	320;	"	647	11	10½	"	129
13.	748	19	10½	"	54;	123	11	7½	"	125;	"	547	13	8½	"	154
14.	231	8	9½	"	29;	164	11	11½	"	128;	"	659	17	9½	"	108
15.	134	17	11½	"	39;	156	18	10½	"	164;	"	541	17	11½	"	134
16.	261	15	10½	"	58;	654	19	9½	"	351;	"	862	9	10½	"	168
17.	129	16	11½	"	89;	692	17	11½	"	67;	"	391	15	11½	"	54
18.	194	15	8½	"	123;	694	19	9½	"	351;	"	768	17	10½	"	328
19.	154	15	5½	"	261;	729	14	11½	"	254;	"	397	14	8½	"	156
20.	729	13	6½	"	129;	654	12	11½	"	124;	"	125	17	11½	"	134

21. £827 10s. to be paid in four equal instalments at 1, 2, 3, and 4 months.

22. £960 to be paid $\frac{1}{3}$ in 2 months, $\frac{1}{3}$ in 4 months, $\frac{1}{4}$ in 5 months, and the remainder in 6 months.

23. A debt to be paid in $\frac{1}{10}$ in 2 months, $\frac{1}{5}$ in 3 months, $\frac{1}{6}$ in 4 months, and the balance in 12 months.

24. £1000, one-half at 1 month, and the remainder in successive instalments of £100, each instalment 1 month after the previous one.

25. £8000, $\frac{1}{3}$ to be paid at once, and of the remainder $\frac{1}{4}$ in 3 months, $\frac{1}{4}$ in 6 months, and the balance in 9 months.

BARTER.

1. If 5 cwt. of sugar, worth 6d. per lb., be exchanged for cloth worth 10s. 8d. per yard, how much cloth must be given?

2. A gives B 31 pieces of linen cloth, each 25 yards at 2s. 3d. per yard, for which he receives from B 16 pieces of flannel, each 48½ yards, worth 1s. 11d. per yard. Which of them gains by the transaction, and how much?

3. A person gave 1216 yards of cloth, worth 14s. per yard, in exchange for sugar, and received 48 hhds. of sugar, each weighing, net, 6 cwt. 2 qrs. 22 lbs. What was the sugar reckoned at per lb.?

4. Exchanged a quantity of cloth, worth 5s. per yard ready money, for 4 cwt. 32 lbs. of cotton, at 15d. per lb. ready money, but valued at 16½d. per lb. in barter. At what rate per yard must the cloth be charged in barter, and how many yards must be given for the cotton?

5. A hatter has 30 hats, worth 4s. 6d. each ready

money, but which he values at 5s. in barter, and he exchanges them for ribbon, worth 16d. per yard ready money, but which is valued at 18d. per yard in barter. Does the latter gain or lose by the bargain, and how much?

6. How much bank stock at $252\frac{1}{2}$ per cent. must be given in exchange for £4000 worth of railway stock at $165\frac{1}{4}$ per cent?

7. A cotton planter exchanged 45 bales of cotton, each weighing 240 lbs., and worth $15\frac{1}{2}$ d. per lb., for 1000 pieces of calico, each containing $42\frac{1}{2}$ yards, and worth 4d. per yard. Did he gain or lose, and how much, by the transaction?

8. A has 123 shawls, worth £2 2s. 6d. each ready money, but which he values at £2 7s. 3d. each in barter, and he exchanges them for tobacco worth £7 14s. 9d. per cwt. ready money. What ought the tobacco to be valued at in barter, and what quantity ought to be given to A?

9. A sugar dealer has 5 tons 12 cwt. of sugar, worth £1 10s. per cwt. ready money, but valued at £1 11s. 6d. in barter, and he exchanges it for butter worth £4 per cwt. ready money. Find the barter value of the butter, and also the quantity that ought to be given for the 5 tons 12 cwt. of sugar.

PROFIT AND LOSS.

1. If 120 sheep are bought at £2 5s. per sheep, and afterwards sold at £2 8s. 6d., what is the total gain?

2. Bought 3 cwt. of sugar for £5 12s., and afterwards sold it at the rate of $4\frac{1}{2}$ d. per lb.; what was the total gain?

3. Bought 2 cwt. of raisins at $7\frac{1}{2}$ d. per lb., and lost on the sale of them 9s. 4d.; what was the loss per lb.?

4. A cattle dealer bought 39 head of cattle, and gave at the rate of £53 12s. 6d. for 3; he afterwards sold them at the rate of £91 17s. 6d. for 5; how much did he gain or lose?

5. A grocer buys 5 cwt. 14 lbs. of tea for £95 13s. 4d., and retails it at $3\frac{1}{2}$ d. per oz.; what is his total gain or loss?

6. If I buy 250 yards of cloth at 7s. 10d. per yard, and afterwards sell it at 8s. 6d. per yard, what is the total gain?

7. A poulterer buys 75 geese for £14 7s. 6d., and in selling them he obtains an average price of 4s. 8d. per goose; what is his total gain?

8. A person bought 5000 eggs at the rate of 2s. 1d. per 100; while in his warehouse 150 were broken. He afterwards sold the remainder at the rate of 13 for a shilling. What did he gain by the transaction?

9. Bought 540 yards of calico for £8 8s. 9d., and afterwards sold the whole for £9; what did I gain per yard?

10. If, in selling an article, the seller gains $1\frac{1}{4}$ d. in the shilling, what is the gain per cent?

11. A merchant bought 30 bales of cotton, averaging 260 lbs. per bale, for £325, and afterwards sold the whole at the rate of £11 18s. 4d. per bale; how much did he gain or lose, and how much per cent.?

12. A grocer bought 75 lbs. of tea for £13 2s. 6d., and in selling the whole he gained the cost of 5 lbs.; what did he gain per cent.?

13. A horse dealer bought 25 horses for £462 10s., and in selling them gained 10 per cent. Find the total selling price.

14. If, in selling tea at 4s. per lb., I gain 10 per cent., what would have been the gain per cent. if I had sold it at 4s. 4d. per lb.?

15. If a merchant, in selling coal at 16s. per ton, gain 5 per cent., what would have been his gain per cent. if he had sold it at 16s. 8d. per ton?

16. By selling cotton at 9d. per lb. a merchant gains 8 per cent.; what must he have sold it at per lb. so as to have neither gained nor lost?

17. A fruiterer having bought 1350 oranges at 5 for a penny, and an equal number at 3 for a penny, sold the whole at 4d. per dozen. How much did he gain or lose per cent.?

18. A stationer having sold a quantity of paper for 11s. 6d. gained 15 per cent. What would he have gained per cent. if he had sold it for 12s.?

19. Having bought a parcel of goods for £18, for which I paid cash, I sold the same immediately, for £25 with 4 months' credit. What was the gain per cent. per annum?

20. A draper bought 40 yards of cloth at 3s. per yard, but 6 yards were completely spoiled by a fire; at what rate per yard must he sell the remainder with 8 months'

credit, so as to gain, on the total prime cost, at the rate of 10 per cent per annum?

21. A horse dealer sold a horse for £40, and lost 20 per cent. by him, whereas he ought to have gained 30 per cent. by the sale. How much was the horse sold under value?

22. If a tea dealer buy 3 cwt. of tea for £63, what must he sell it at per lb. so as to gain 10 per cent?

23. By selling 12 pairs of shoes for £5 14s., the dealer gained 8 per cent. What did the shoes cost him per pair?

24. A cotton merchant bought, for ready money, 40 bales of cotton, each weighing 270 lbs., for £450; and, supposing he sold it for ready money, he proposed to gain 25 per cent. by the sale; but he afterwards sold the whole with 6 months' credit, and gained 10 per cent. per annum additional on the ready money selling price. Find the selling price per lb.?

FELLOWSHIP WITHOUT TIME.

1. A and B trade together, A's share of capital being £3200, and B's £2400: they gain £1390; what is each man's share of the gain?

2. A house worth £1200, and insured for £850, was totally destroyed by fire. If $\frac{1}{4}$ belonged to A, $\frac{1}{3}$ to B, and the rest to C, what loss will each man sustain?

3. A, B, and C furnish to a common stock respectively £276 15s., £129, and £92 2s.: they gain £99 13s.; what is each man's share?

4. A, B, C, and D put into a common stock respectively £270, £461, £500, and £329: their total gain amounts to £1070; what is each man's share?

5. A, B, and C purchased a patent, A taking $\frac{3}{8}$, B $\frac{1}{4}$, and C paying £525; what money did A and B each advance?

6. A, B, and C join in a speculation, advancing respectively, A £827 2s., B £1213, and C £456 18s.: they gain £1947 15s.; what is A's share of the gain?

7. Divide £963 amongst 3 persons in the proportions of 9, 15, and 20.

8. Three persons trade together and gain £1400; A £400; B £600; C £750; what is each man's share of the gain?

9. A, B, C, and D trade together with a capital of £10,000, of which A contributed $\frac{1}{10}$, B $\frac{1}{5}$, C $\frac{1}{10}$, and D, the remainder: they gain £2500; how shall it be divided?

10. A contributes £150 of capital, B £200: they gain £21; how much shall each have?

11. A is a creditor in an estate for £60, B for £90, and C for £120: the total dividend due to them is £150; what will each man receive?

12. A cargo, consisting of £800 barrels of beer, of which A sent 140, B 310, and C the remainder, is partially lost, 70 barrels being thrown overboard in a storm; how many barrels will each lose?

13. A, B, and C begin trade with £1000, of which A contributes $\frac{1}{4}$, B $\frac{3}{10}$, and C the remainder: they lose all their capital except £250; how ought that to be divided?

14. Divide £100 amongst three persons so that for every £5 A has, B shall have £3, and C £2.

15. A and B rent a house for £21. A occupies it $\frac{2}{3}$ of the year, and B the remainder; what part of the rent should each pay?

16. A house belonging to 4 persons, and worth £20,000, was burnt down; A and B had each contributed £2500, C £5000, and D the remainder of the purchase money: the house was insured for £4500; what did each receive and lose?

17. 46 acres, 3 roods, 35 perches of land are to be divided amongst A, B, C, and D in proportion to their estates: A's estate is worth £80, B's £120, C's £200, and D's £300 a year; what quantity of land must each have?

18. Divide £1628 into four shares in the proportions of 4, 5, 6, and 7.

19. Four men spent £1, of which they ignorantly agreed that A should pay $\frac{2}{4}$, B $\frac{1}{2}$, C $\frac{1}{4}$, and D $\frac{1}{8}$; what must each pay according to this proportion?

20. A, B, and C hired a shepherd for £7 15s.; A gives him the care of 540 sheep, B of 710, and C of 876; what are their fair proportions of the payment?

FELLOWSHIP WITH TIME.

1. A and B trade jointly, A putting in a capital of £250 for 3 months, and B £325 for 4 months: they gain £102 10s.; what was each man's share of the gain?

2. Three persons trade together, A contributing a capital of £96 for 8 months, B £58 for 14 months, and C £40 for 22 months; they gain £240; what is each man's share of the gain?

3. A, B, and C hold a piece of ground jointly at a rent of £36 10s. 6d.; A puts in 23 oxen for 27 days, B 21 for 35 days, C 16 for 23 days; what proportion of the rent ought each man to pay?

4. A subscribes capital to the amount of £519 10s. for $8\frac{1}{2}$ months, B £706 15s. for $10\frac{1}{2}$ months, C £876 5s. for $12\frac{1}{2}$ months; what is each man's share of their gain, amounting to £303 3s.?

5. Two farmers hired a piece of land for £80; A put in 50 sheep to graze for 5 months, B 200 for 3 months; what has each to pay?

6. A and B hold a piece of land, costing £54, in common; A puts in 23 horses for 27 days, and B 21 for 39 days; how much ought each to pay?

7. A and B trade together; A put in £150 on the 1st of January, but B did not join till May 1st; what did he then put in to have an equal share with A at the end of the year?

8. A and B form a partnership for 2 years, A contributing £1000, and B £1600. After 9 months have elapsed they admit C, with a capital of £2000; and the total profit made is £1201 4s.: what is each man's share?

9. Three graziers hire a piece of land for £60 10s.; A puts in 50 sheep for $4\frac{1}{2}$ months, B 80 for 5 months, and C 90 for $6\frac{1}{2}$ months; how much must each pay?

10. Three persons trade together: A puts in £184 10s. for 2 months, B £96 15 for 3 months, and C £220 12s. for 4 months; they gain £300; what is each man's share of the gain?

11. A, B, and C rent a pasture in common for £30 per annum. A puts in 14 sheep for 3 months, B 18 sheep for 5 months, and C 8 sheep for 12 months; how much rent must each pay?

12. Two merchants enter into partnership for 18 months; A puts into the common stock at first £200, and at the end of 8 months puts in £100 more; B puts in at first £550, and at the end of four months takes out £140; at the end of 18 months they find their gain to be £526; what is each man's share?

13. A begins trade January 1st with a capital of £1000, B joins him March 1st with £1500, three months subse-

quently C joins them with £2800; they trade together till the end of the year and gain £1776 10s.; how must it be divided?

14. A, B, and C go into partnership for 12 months; A at first puts in £20, and 4 months after £20 more; B puts in at first £30, at the end of 3 months £20 more, and at the end of 5 months £40 more; C puts in at first £60, at the end of 5 months £10 more, and at the end of 6 months withdraws £30; during the 12 months they gain £50; what is each man's share of the gain?

15. A, B, and C join in partnership for 18 months; A puts in at first £200, after 8 months £100 more, and after 10 months £50 more; B puts in at first £550, but after 4 months he takes out £140, and after 7 months £110 more; C puts in at first £600, but after 2 months he takes out £250, and after 14 months puts in £300: at the expiration of the 18 months the gain is £526; what is each man's share?

ANNUITIES, FREEHOLDS, AND LEASES.

1. What will be the amount of an annuity of £84 payable yearly, but forborne for 24 years, at 5 per cent. compound interest?

2. What will the rents of an estate of £127 a year amount to in 17 years at 5 per cent. compound interest?

3. What will be the amount of a pension of £39 a year allowed to be unpaid for 19 years at $3\frac{1}{2}$ per cent.?

4. If an annuity of £27 6s. 8d., payable yearly, has not been drawn for 40 years, find the amount due at 4 per cent. compound interest.

5. If an annual salary of £350, payable yearly, be not paid for ten years, what sum is due at 5 per cent. compound interest?

6. If the rent of a mill at £93 a year run into arrears for 9 years, what sum is due at $3\frac{1}{2}$ per cent. compound interest?

7. What is the present value of an annuity of £50 a year for 14 years at 4 per cent.?

8. What present sum must be given for an annuity of £100 a year, payable for 21 years, at 4 per cent.?

9. How much must be paid for an annuity of £150 a year for 20 years, payable annually, allowing 5 per cent.?

10.* What is the value of a perpetual annuity of £84 a year, interest being at 3 per cent. ?

11. What is the value of an estate worth £800 a year in perpetuity, interest at $4\frac{1}{2}$ per cent. ?

12. What sum paid down will secure an annual income of £170 for 15 years, interest at 3 per cent. ?

13. What must be paid for an annuity of £70 a year, commencing 10 years hence, and continuing 15 years, at 5 per cent. ?

14. What is the present value of an annuity of £450, which commences 10 years hence and continues for 50 years, interest at 4 per cent. ?

15. What is the present value of a lease commencing 5 years hence, continuing 16 years, and producing £75 a year, at 4 per cent. ?

16. A father left his estate of £350 a year to his younger son for 5 years, and in perpetuity to his elder son afterwards; what was each one's legacy worth on the day the younger came into possession, money being worth 4 per cent. ?

17. What is the value of a freehold estate worth £724 16s. per annum, payable half-yearly, interest being $3\frac{3}{4}$ per cent. ?

18. A freehold estate is bought at 18 years' purchase for £9819, what should be the annual rent ?

19. What sum must be paid for a perpetual annuity of £100 a year at 4 per cent. ?

20. What must I give for a freehold let for £100 a year, so as to have 5 per cent. for my outlay ?

21. How much should be given for the lease of a farm for 21 years so as to gain 4 per cent., the rent being £45 a year ?

22. What is the value of a house on a lease equal to a perpetuity, the rent being £40 a year; but a ground rent of £4 a year having to be deducted, the purchase to pay 7 per cent. ?

23. How many years' purchase should be given for freehold property to clear 6 per cent. ?

24. If £333 6s. 8d. be given for a freehold estate worth £20 a year, what per centage is gained for the outlay ?

25. If $6\frac{1}{2}$ per cent. be gained by purchasing a freehold estate, for how many years' purchase was it bought ?

26. What is the lease of an estate for 15 years, paying

* The value of a perpetual annuity is found by dividing the annuity by the rate of £1 for a year.

an annual rent of £90, worth, money being at 5 per cent. ?

27. What must a person whose probability of life is 20 years, give for a life annuity of £60, money being worth 3 per cent. ?

28. Which is the more valuable, and by how much, a leasehold estate of £89 a year for 50 years, or a freehold estate of £45 a year, interest at 4 per cent. ?

29. How much should be paid for a leasehold farm equal to a perpetuity, and bringing in £350 a year, but subject to deductions amounting to £90 a year, so that the purchaser may get 4 per cent. on his outlay ?

30. A farm, worth £150 a year, is taken for 15 years, the tenant to pay £300 down, and the remainder as a yearly rent ; what must that yearly rent be so as to give the owner 3 per cent. for his money ?

SCALES OF NOTATION.

<i>Bring from the to the</i>	<i>Bring from the to the</i>
1. 8767 denary binary.	21. 4tet duodenary undenary.
2. 7654 octenary trinary.	22. 7316 octenary binary.
3. 4323 quinary binary.	23. 6354 septenary quaternary.
4. 1986 denary undenary.	24. 1210 trinary binary.
5. 7215 octenary senary.	25. 3121 quaternary denary.
6. 8517 nonary quaternary.	26. 1654 septenary binary.
7. 5134 senary duodenary.	27. 5176 octenary nonary.
8. 3123 quaternary denary.	28. 3132 quaternary trinary.
9. 6413 septenary nonary.	29. tett duodenary binary.
10. 8127 nonary duodenary.	30. 5t16 undenary quaternary.
11. 5t26 undenary binary.	31. 6917 denary duodenary.
12. e6t4 duodenary trinary.	32. t594 undenary trinary.
13. 5362 senary denary.	33. 7e8t duodenary trinary.
14. 7465 octenary trinary.	34. 9156 denary duodenary.
15. 2120 trinary quaternary.	35. 8te9 duodenary octenary.
16. 1010 binary duodenary.	36. 7t56 undenary quinary.
17. 6534 septenary quinary.	37. 5679 denary undenary.
18. 3120 quaternary denary.	38. t98e duodenary quinary.
19. 4134 quinary binary.	39. 5t64 undenary binary.
20. 3130 quaternary undenary.	40. 6413 septenary duodenary.
41. Add in the octenary scale $516 + 3174 + 65 + 67 + 5$.	
42. Subtract in the duodenary scale te659 from 9e6541.	
43. Multiply in the nonary scale 8563 by 27 ; 65 ; and 36.	

44. Divide in the undenary scale $7t641$ by $t5$; $6t$; and
 59.
 45. Add in the binary scale $101 + 111 + 1011 + 1001 + 11$
 + 1.
 46. Subtract in the quaternary scale 1321032 from
 1332132 .
 47. Multiply in the quinary scale 134121 by 132 ; 443 ;
 and 413 .
 48. Divide in the septenary scale 156215 by 3416 ; 415 ;
 and 564 .
 49. Add in the duodenary scale $te7 + 51e + 689 + t7e + 519$
 50. Subtract in the undenary scale $78t514$ from $961t85$.
 51. Multiply in the duodenary scale $87tee$ by te ; $5t$;
 and $6e$.

SQUARE ROOT.

Find the square root of :—

1. 9025	27. 1258
2. 1	28. 151426
3. 5625	29. 974169
4. 1936	30. 000294
5. 2601	31. 989
6. 1024	32. 99856
7. 10201	33. 213444
8. 45369	34. 152399025
9. 39601	35. 22071204
10. 42025	36. 36372961
11. 64516	37. 15241578750190521
12. 82369	38. 36-00000625
13. 120409	39. 21035-8
14. 126025	40. 106929
15. 148225	41. 11955866912
16. 219961	42. 14876-2357
17. 259081	43. 4795-2573
18. 302500	44. 1-270054
19. 368449	45. 36372961
20. 535824	46. 00032754
21. 603729	47. 3-1721812
22. 703921	48. 7596796
23. 751689	49. 3271-4207
24. 984064	50. 22071204
25. 9608	51. 2268741
9558	52. 00032754

53. 2·2710957	76. 12
54. 1788·57	77. 9
55. 317·695	78. 10
56. 3721·4007	79. $\frac{3}{14}$
57. 368863	80. $\frac{3}{36}$
58. 7596796	81. $\frac{37}{147}$
59. 119550669121	82. $\frac{64}{81}$
60. 3·1721812	83. $\frac{9}{14}$
61. ·00032754	84. $6\frac{2}{3}$
62. 4·000067121	85. $\frac{3}{4}$
63. ·0000648070	86. $\frac{9916}{12554}$
64. ·95801234	87. $\frac{3168}{6192}$
65. ·00015241578750190521	88. $51\frac{1}{3}$
66. 6·27	89. $17\frac{3}{8}$
67. ·4325	90. $15\frac{1}{8}$
68. 5·3	91. $1606\frac{673}{1409}$
69. 2	92. $\frac{7}{8}$
70. 3	93. $2\frac{7}{9}$
71. 5	94. $30\frac{1}{4}$
72. 4276·6	95. $11\frac{1}{9}$
73. 7	96. $156\frac{1}{4}$
74. 6	97. $\frac{3}{8}$
75. 11	98. $10\frac{19}{9}$
	99. $345\frac{3}{4}$

100. The hypotenuse of a right angled triangle is 27 yards long, and one of the legs 23 yards; how long is the other leg?

101. How many links long is the side of a square whose area is 124·25625 acres?

102. When standing $55\frac{1}{2}$ yards from a tower, a cord of $140\frac{1}{2}$ yards long reached me from the top of it; what was the height of the tower?

103. A square orchard contains 3969 square yards; what will it cost to fence it at 3s. $7\frac{1}{2}$ d. per yard?

104. Two men set out from the same point: one travels 252 miles due west, and the other 150 miles due south; how far are they now apart?

105. A pole 40 feet long reaches a window 21 feet high on one side of the street, and from the same point a window 33 feet high on the other side; what is the width of the street?

CUBE ROOT.

Find the cube root of:—

1. 1728	34. 9938375	67. $\cdot 053157376$
2. 5842	35. 907039232	68. 132
3. 6859	36. 890277128	69. 5592
4. 9261	37. 709732288	70. $\cdot 354$
5. 17576	38. 681472000	71. 576
6. 32768	39. 768575296	72. $\cdot 009$
7. 50653	40. 982107784	73. $\frac{1\frac{2}{3}}{51\frac{3}{5}}$
8. 74088	41. 794022776	74. $\frac{3\frac{2}{3}}{15\frac{4}{5}}$
9. 97396	42. 707347971	75. $405\frac{2\frac{2}{3}}{1\frac{2}{5}}$
10. 125000	43. $99\cdot 252847$	76. $31\frac{1\frac{2}{3}}{3\frac{2}{3}}$
11. 205379	44. $128\cdot 024064$	77. $12\frac{1\frac{2}{3}}{4\frac{2}{3}}$
12. 262144	45. $\cdot 0001357$	78. $\frac{1\frac{2}{3}}{4\frac{2}{3}}$
13. 373248	46. $\cdot 001906624$	79. $1\frac{1}{10}$
14. 438976	47. 171	80. $51\frac{1}{2}$
15. 493039	48. 39651821	81. $111\frac{1}{6}$
16. 830584	49. 5725732069	82. $13\frac{2}{3}$
17. 941192	50. $349359908\cdot 507$	83. 171 to 17 places
18. 1124864	51. $72147\cdot 158747$	84. $\frac{27\frac{2}{3}}{37\frac{2}{3}}$
19. 1442897	52. $17\cdot 3750$	85. $\frac{1\frac{2}{3}}{4\frac{2}{3}}$
20. 1601613	53. $345815367977\cdot 871$	86. $2\frac{1}{2}$
21. 1728000	54. $8232\cdot 1032709$	87. $405\frac{1\frac{2}{3}}{5\frac{2}{3}}$
22. 1906624	55. 27054036008	88. $13\frac{2}{3}$ to 12 places
23. 2048383	56. 122615327232	89. $\frac{4}{9}$
24. 2197009	57. $1\cdot 740992427$	90. $\frac{5}{9}$
25. 2571353	58. $171\cdot 46776406$	91. $12\frac{1}{2}$
26. 4096000	59. $\cdot 0001357$	92. $31\frac{1\frac{2}{3}}{4\frac{2}{3}}$
27. 3723875	60. $30\cdot 625$	93. $405\frac{2\frac{2}{3}}{1\frac{2}{5}}$
28. 4492125	61. $\cdot 00533$	94. $7\frac{1}{2}$
29. 3796476	62. $71\cdot 125$	95. $9\frac{1}{6}$
30. 3307949	63. $\cdot 00032754$	96. $8\frac{2}{3}$
31. 8489664	64. 673373097125	97. $\frac{51\frac{2}{3}}{47\frac{4}{5}}$
32. 7189057	65. 122615327232	98. $3\frac{1}{3}$
33. 6644672	66. $12\cdot 977875$	99. $7\frac{2}{3}$

100. 5591999266292267943659

101. What is the length of the side of a cubic stone containing 13,824 solid feet?

102. What must be the depth of a cubical box that shall contain 125,000 cubic feet?

103. A cistern, containing 125 solid feet, has to be lined

with lead at $2\frac{1}{2}$ per lb., and $4\frac{1}{2}$ lbs. of lead to every square foot; what will the lead lining cost?

104. A square kiln contains 140,608 cubic feet of space; what did the brick lining of it cost if 9 inches thick, covering the sides and the bottom, and charged at 1d. per square foot of exterior surface?

105. A room, whose width and height are equal, but its length three times as much, and which contains 5184 cubic feet of space, has its walls papered at 4d. per square yard; what was the cost?

106. How far is it round the top of a square well, which is ten times as deep as it is wide, and contains, when full, 1250 cubic feet of water?

DUODECIMALS AND MENSURATION.

	ft.	'		ft.	'		ft.	'	"	ft.	'	"			
1.	7	9	×	3	6		21.	7	5	9	×	3	5	3	
2.	8	5	×	4	7		22.	10	4	5	×	7	8	6	
3.	9	8	×	7	6		23.	9	3	4	×	8	9	7	
4.	8	1	×	3	5		24.	5	8	4	×	8	10	0	
5.	7	6	×	5	9		25.	107	2	3	×	36	7	0	
6.	4	7	×	3	10		26.	35	4	6	×	12	3	0	
7.	75	7	×	9	8		27.	64	6	0	×	8	9	3	
8.	97	8	×	8	9		28.	7	8	9	×	7	8	9	
9.	57	9	×	9	5		29.	49	7	8	×	14	8	6	
10.	75	9	×	17	7		30.	311	4	7	×	35	7	5	
11.	87	5	×	35	8		31.	321	7	3	×	9	3	6	
12.	179	3	×	38	10		32.	527	10	5	×	7	6	9	
13.	179	3	×	7	6		33.	74	6	6	×	3	4	2	
14.	97	8	×	8	9		34.	8	7	5	×	7	9	4	
15.	259	2	×	48	11		35.	2	3	1	×	5	7	9	
16.	34	4 $\frac{1}{2}$	×	12	3		36.	311	7	5	×	36	4	11	
17.	64	6	×	8	9 $\frac{1}{4}$		37.	45	11	4	×	18	11	3	
18.	41	5	×	8	7		38.	4	3	2	1 ^{'''}	×	1 ^{ft.} 2' 3 ^{''} 4 ^{'''}		
19.	35	8	×	9	11		39.	442	9	2	4 ^{'''}	×	2	4	6
20.	28	3	×	13	9		40.	10	8	7	5 ^{'''}	×	9	4	9

41. What is the area of a parallelogram whose length is 12·25, and breadth 8·5?

42. The side of a square is 35·25 chains; what is its area?

43. Find the content of a rectangular board whose length is $12\frac{1}{2}$ ft. and breadth 9 in.

44. The area of a square is 9025 yards; what is its side?

45. What will a carpet cost for a room 18ft. 6in. long and 14ft. 3in. broad, at 3s. per square yard?

46. What is the cost of a slab 11ft. 2in. long and 7ft. 4in. wide, at 2s. per square foot?

47. What is the value of a plot of building land 79 ft. 6 in. long and 52 ft. 8 in. wide, at 2s. per square foot?

48. How many acres are there in a rectangle whose sides are 326 and 153ft.?

49. What will it cost to fence a square whose area is 1369ft., at 3d. per lineal foot?

50. What is the area of a rectangular piece of land 1375 links by 950?

51. What is the content of a rectangle 2ft. 10' 6" by 9 inches?

52. What is the value of a square field whose side is 35·25 chains, at £120 per acre?

53. The side of a parallelogram is 12·25 chains, and its area 10 ac. 1 r. 26 po.; how many chains long is the other side?

54. What will it cost to paint the walls and ceiling of a room 18ft. long, 15ft. wide, and 12ft. high, at 5½ per square yard?

55. A court yard 85ft. by 34ft., has to be paved with stones 8in. by 6; how many stones will it take, and what will the work cost at 3s. per square yard?

56. What is the area of a triangle whose base is 6·25 chains, and perpendicular height 5·20 chains?

57. Find the area of a triangle whose three sides are 20, 30, and 40 chains?

58. What is the area of a triangle whose base is 18ft. 4in. and height 11ft. 10in.?

59. A triangular field, whose sides are 380, 420, and 765 yards, lets for 55 shillings per acre; what is the yearly rent?

60. The diagonal of a field in the form of a trapezium is 1660 links, and the perpendiculars 702 and 712 links; what is its area?

61. In the trapezium A, B, C, D, the side A D is 15, D C 13, C B 14, and A B 12; also the diagonal A C 16; what is the area?

62. Required the area of a trapezium whose diagonal is 1268 links, and the perpendiculars from either oppo-

site angles upon the diagonal 784 and 672 links respectively.

63. What is the area of a circle whose diameter is 7.5 feet?

64. What is the area of a circle whose circumference is 178 inches?

65. What is the area of the semicircle of which 20 is the radius?

66. What length must a cord be to tether a cow in the centre of an acre of grass?

67. If the diameter of a circle be 100, what is the side of a square equal in area to the circle?

68. What is the diameter of a circle containing half an acre?

69. What is the area of a circle the difference of whose diameter and circumference is 1056.64 feet?

70. What is the area of a circular ring, the diameter of the inner circle being 10, and of the outer 20?

71. What is the area of a sector whose radius is 10 feet, and arc 20 feet?

72. Find the area of a quadrant and of a semicircle whose radius is 13.

73. What is the area of a sector whose arc contains 18 degrees, the radius being 4 ft.?

74. What is the area of a sector whose arc is $56^{\circ} 30'$, and radius 30?

75. What is the area of an ellipse whose axes measure 20 ft. and 16 ft. respectively?

76. What is the area of an ellipse whose radii are 14 and 20?

77. An oval fish pond is 100 ft. long and 84 ft. wide, what will its bottom cost paving at $3\frac{1}{2}$ d. per square foot?

78. An oval, whose diameters are 540 and 480 ft., is to be planted with shrubs, the plants and workmanship costing 8d. per yard; what will be the cost of the whole?

79. What is the convex surface of a cylinder whose circumference is 76 in., and length 5 ft. 4 in.?

80. What is the surface of a cylinder, including the ends, its girt being 12 ft., and length 15 ft.?

81. What will it cost to cover a roller 4 ft. in girt, and 12 ft. long, with leather at 1d. per square inch?

82. Required the interior surface of a cylinder, the length 12 ft., and the radius of the bore 23 in.?

83. What is the surface of a cone whose slant side is 10 ft., and the radius of the base 2 ft. 5 in.?

84. What will it cost to paint the spire of a church that is 40 ft. round the base and 100 ft. high in the slant part, at 3d. per square foot?

85. What will it cost to re-dress the stone surface of a church spire 50 ft. in slant height, with a diameter of 8 ft. 6 in. at the base, the work being paid at 5d. per square foot?

86. A piece of timber is 25 ft. long, 3 ft. wide, and 5 ft. thick; what is its solid content?

87. What is the solidity of a block of stone 5 ft. 6 in. long, 3 ft. 2 in. wide, and 1 ft. 9 in. thick?

88. How many feet of stone have been dug from a quarry 20 ft. deep, 16 ft. wide, and 30 ft. long?

89. How many cubic feet of air are there in a room 12 ft. high, 18 ft. long, and 15 ft. 9 in. wide?

90. What will it cost to dig out a quantity of brick clay 5 ft. deep, 18 ft. wide, and 39 ft. long, at 9½d. per cubic yard?

91. What will it cost to dig holes for 500 posts, each hole being a square, the side 1 ft. 6 in. and the depth 3 ft., the work being paid at the rate of 9½d. per solid yard?

92. What will it cost, at 8½d. per cubic yard, to dig the cellars of 8 houses, each cellar being 4 yards long, 3½ yards wide, and 5½ ft. deep?

93. What is the solidity of a triangular prism whose length is 10 ft., and the three sides of its triangular base, 5, 4, and 3 ft. respectively?

94. What is the solid content of a quadrilateral prism, the length 19 ft., the sides of the base 43, 54, 62, and 38 feet, and the diagonal between the first and second 70 in.?

95. What is the solidity of a prism whose base is an equilateral triangle each side being 4 ft., and the height 10 ft.?

96. A prismatic vessel with a square base, each side of which is 4 ft., and with a height of 9 ft., is emptied by a tap discharging 120 cubic inches of water per minute; how long will the water be running out?

97. The length of a stone roller is 6 ft., and its circumference 96 in.; how many solid feet are there in it?

98. How long must a cylinder that is 3 ft. 8 in. in circumference be to contain 18 cubic feet?

99. What is the solidity of a cylinder whose circumference is 3 ft., and length 10 ft.?

100. What is the solidity of a square pyramid, each side of whose base is 30 ft., and its height 33 ft. ?

101. Find the content of a triangular pyramid, its height being 14 ft. 6 in., and the three sides of its base 5, 6, and 7 ft. ?

102. A square pyramid, whose height is 30 ft., and each side of its base 5 ft., costs 6d. per solid foot, and 2d. per square foot polishing ; what is its total cost ?

103. What will be the cost of a triangular pyramid at 7½d. per solid foot, the sides of its base being 13, 14, and 15 ft., and its altitude 63 ft. ?

104. What is the content of a cone, whose diameter at the base is 3½ ft., and its height 12 ft. ?

105. What is the solidity of a conical spire whose base is 91 ft. in circumference, and height 150 ft. ?

106. What would a square pyramidal monolith cost at 6d. per solid foot, the sides of whose base are each 9 ft., and its height 164 ft. ?

107. What will it cost to cart away, at 1s. 4d. per solid yard, a conical mound of earth whose base has a diameter, of 40 ft., its height being 30 ft. ?

THE CHAIN RULE.

1. If 6 lbs. of sugar are equal in value to 7 lbs. of raisins 5 lbs. of raisins to 2 lbs. of almonds, 3 lbs. of almonds to 5 lbs. of currants, and 2 lbs. of currants to 18d. ; how many pence are 3 lbs. of sugar worth ?

2. If the rent of land in France is 150 francs per hect-acre, what is the rent per acre in English money, 100 hectares being equal to 247 acres ?

3. If 3 dozen pairs of gloves be equal in value to 2 pieces of ribbon, 3 pieces of ribbon to 7 pairs of stockings, 6 pairs of stockings to 2 yards of Brussels lace, and 3 yards of Brussels lace to 81 shillings ; how many dozen pairs of gloves may be bought for 28 shillings ?

4. 1 cwt. of flour yields 36 quartern loaves. Calculate the value of the 2 lb. loaf, flour being 52s. 6d. per sack of 2½ cwt., 5s. per sack being the cost of manufacture, and 10 per cent. being allowed for profit.

5. What is the ratio of the English mile to the French kilomètre, the kilomètre being equal to 1,000 mètres, and 64 mètres equal to 70 yards ?

6. Coal costs 21s. per ton, and its heating power compared with that of an equal weight of coke is as 5 : 4 ; what is the value of 1 chaldron of coke, $1\frac{1}{2}$ chaldrons being equal to 1 load, and 1 load weighing 21 cwt. ?

7. If £1 in London is equal to 12 florins in Amsterdam, $35\frac{1}{4}$ florins at Amsterdam equal to 40 marks banco at Hamburg, and 100 marks banco equal to 185 francs in Paris ; how many francs in Paris are equal to £1 in London ?

8. What is the value of a Sicca rupee which weighs 7 dwts. 12 grs., and consists of 979 parts out of 1,000 of fine silver, the value of standard silver, which is 37-40ths fine, being 5s. 2d. per oz. troy ?

9. A sack of flour weighs $2\frac{1}{2}$ cwt. and yields 90 quartern loaves ; what number of quartern loaves may be made from a quarter of wheat, supposing it to yield 80 per cent. of white flour ?

10. If 10 lbs. in London are equal to 9 lbs. at Amsterdam, 49 lbs. at Amsterdam to 49 lbs. at Bruges, and 98 lbs. at Bruges equal to 116 lbs. at Dantzic ; how many lbs. in Dantzic are equal to 112 lbs. in London ?

EXCHANGE.*

AUSTRIA, MUNICH, AND BADEN.

9 Florins 50 Kreutzers \pm = £1 Sterling.

<i>Exchange:—</i>			<i>Exchange:—</i>		
£ Strl.		Fl. Kr.	Flor. Kr.		Flor. Kr.
1. 420	for Florins at	10 2	6. 1560	0 for Strl. at	9 50
2. 216	.. ..	10 $1\frac{1}{4}$	7. 2375	0	10 1
3. 377	.. ..	9 58	8. 1458	35	9 57 $\frac{1}{2}$
4. 658	.. ..	9 30	9. 5050	0	10 30
5. 724	.. ..	9 50	10. 1378	53	10 $1\frac{1}{2}$

BREMEN.

$6\frac{1}{3}$ Thalers Louis d'or \pm = £1 sterling.

<i>Exchange:—</i>			<i>Exchange:—</i>		
£ Strl.		Th. L.	Thalers L.		Th. L.
1. 840	Thalers L. at	$6\frac{1}{3}$	6. 5840	for Strl. at	$6\frac{1}{3}$
2. 775	.. ..	$6\frac{1}{6}$	7. 6212	.. ..	$6\frac{1}{3}$
3. 854	.. ..	$6\frac{1}{8}$	8. 7114	.. ..	$6\frac{1}{2}$
4. 527	.. ..	$6\frac{1}{5}$	9. 5110	.. ..	$6\frac{1}{2}$
5. 321	.. ..	$6\frac{1}{4}$	10. 6415	.. ..	$6\frac{1}{2}$

* See Tables of Foreign Money at end of volume.

United States 4 Dollars 80 cents \pm = £1 Sterling. Bills on London sell at a premium of about 9 per cent.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.		Per ct. pre.		Dollars.		Per ct. dis.	
1. 168 10s.	for Dols. at	7 $\frac{1}{3}$		6. 1375	for Strl. at	10	
2. 840 0	.. ..	10		7. 1627 $\frac{1}{3}$	.. ..	8 $\frac{1}{3}$	
3. 768 15	.. ..	8		8. 3225	.. ..	7 $\frac{1}{3}$	
4. 654 0	.. ..	9 $\frac{1}{3}$		9. 3600	.. ..	8	
5. 928 10	.. ..	9 $\frac{1}{2}$		10. 1782 $\frac{1}{2}$	.. ..	9 $\frac{1}{2}$	

CHINA.

1 Dollar \pm = 4s. 8d. Sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.		per Dollar.		Taela.		per Dollar.	
1. 298	for Taela at	55 $\frac{7}{8}$	d.	6. 3000	for Strl. at	56	
2. 250	.. ..	55		7. 1590 $\frac{3}{5}$	.. ..	55 $\frac{3}{8}$	
3. 780	.. ..	56 $\frac{1}{2}$		8. 4544	.. ..	55 $\frac{3}{8}$	
4. 405	.. ..	56 $\frac{1}{4}$		9. 7497 $\frac{3}{5}$	.. ..	55 $\frac{5}{8}$	
5. 267	.. ..	55 $\frac{5}{8}$		10. 1079 $\frac{1}{5}$	.. ..	55 $\frac{7}{8}$	

DENMARK.

9 Rigsbank Dollars 10 Skillings \pm = £1 sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.		R. Dol. Sk.		R. Dol.		R. Dol. Sk.	
1. 420	for R. Dols. at	9 10		6. 4820	for Sterling at	9 10	
2. 560	.. ..	9 6		7. 3710	.. ..	9 12	
3. 875	.. ..	9 3		8. 1622	.. ..	9 8	
4. 220	.. ..	9 15		9. 5620	.. ..	9 16	
5. 340	.. ..	9 12		10. 3486	.. ..	9 6	

FRANCE, BELGIUM, AND SWITZERLAND.

25 Francs 20 Centimes \pm = £1 Sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.		Frs Cts.		Frs. Cts.		Frs. Cts.	
1. 60	for Francs at	25 15		6. 1798 65	for Strl. at	25 30	
2. 140	.. ..	24 44 $\frac{1}{2}$		7. 3392 55 $\frac{1}{3}$	.. ..	23 50 $\frac{1}{3}$	
3. 149	.. ..	25 30		8. 5125 68	.. ..	25 42 $\frac{1}{2}$	
4. 370	.. ..	25 10		9. 6844 60	.. ..	24 44 $\frac{1}{2}$	
5. 410	.. ..	23 42		10. 9230 13	.. ..	25 35 $\frac{1}{2}$	

FRANKFORT ON THE MAIN.

12 Florins 45 Kreutzers \pm = £1 Sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.		Fl. Kr.		Fl. Kr.		Fl. Kr.	
1.	150 for Florins at	12 40		6.	1540 0 for Strl. at	12 30	
2.	265	12 50		7.	9477 20 ..	12 28	
3.	138	12 35		8.	3072 45 ..	12 45	
4.	680	12 28		9.	4862 5 ..	12 45	
5.	482	12 45		10.	9268 50 ..	12 50	

GREECE.

28 Drachmas 15 Lepta \pm = £1 Sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.		Dr. Le.		Dr. Le.		Dr. Le.	
1.	420 for Drach. at	28 15		6.	35187 55 for Strl. at	28 15	
2.	840	28 20		7.	11486 5 ..	28 20	
3.	672	28 10		8.	34031 2 ..	28 32	
4.	321	28 12		9.	18243 55 ..	28 73	
5.	264	28 15		10.	20634 6 ..	28 90	

HAMBURG.

13 Marks banco 10 $\frac{1}{2}$ Schillings \pm = £1 sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.		Mks. Sch.		Mks. Sch.		Mks. Sch.	
1.	325 for Marks at	13 12		6.	14388 0 for Strl. at	13 10	
2.	275	13 10 $\frac{1}{2}$		7.	5000 0 ..	13 12 $\frac{1}{2}$	
3.	149	13 11 $\frac{1}{4}$		8.	4228 15 $\frac{1}{2}$..	13 12	
4.	275	13 12		9.	4896 6 ..	13 13 $\frac{1}{4}$	
5.	466	13 13 $\frac{1}{2}$		10.	2010 2 $\frac{1}{2}$..	13 14 $\frac{1}{2}$	

HOLLAND.

12 Florins \pm = £1 Sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.		Fl. cts.		Fl.		Fl. cts.	
1.	850 for Florins at	12·0		6.	5672· 0 for Strl. at	12·0	
2.	222	11·93		7.	2421·10 ..	12·10	
3.	325	12·7 $\frac{1}{2}$		8.	3091· 7 ..	12·06	
4.	149	11·90		9.	4506·50 $\frac{1}{2}$..	11·92	
5.	350	12·05		10.	2417·96 $\frac{1}{2}$..	11·98	

EAST INDIES.

Rupee \pm = 1s. 10 $\frac{1}{4}$ d. Sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.			d.	Rupees			d.
1. 560	for Rupees	at	22 $\frac{1}{4}$	6. 5960	for Sterling	at	22 $\frac{1}{4}$
2. 876	.. ..		23 $\frac{1}{2}$	7. 8400	.. ..		23 $\frac{1}{4}$
3. 564	.. ..		21 $\frac{3}{4}$	8. 2545	.. ..		24 $\frac{1}{4}$
4. 869	.. ..		21 $\frac{1}{2}$	9. 7528	.. ..		23 $\frac{3}{4}$
5. 964	.. ..		22 $\frac{1}{2}$	10. 8720	... ..		21 $\frac{3}{4}$

ITALY.

25 Lire 22 Centesimi \pm = £1 Sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.			Li. Cen.	Li. Cen.			Li. Cen.
1. 920	for Lire	at	25 22	6. 5630 50	for Strl.	at	25 22
2. 745	.. ..		25 30	7. 3076 71	.. ..		25 35 $\frac{3}{4}$
3. 715	.. ..		24 25	8. 3422 30	.. ..		24 44 $\frac{1}{2}$
4. 670	.. ..		25 20	9. 5870 50	.. ..		25 10
5. 500	.. ..		25 35 $\frac{1}{2}$	10. 1524 15	.. ..		25 40 $\frac{1}{4}$

PORTUGAL.

Milreis \pm = 4s. 10 $\frac{1}{4}$ d. Sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.			s. d.	C. M. R.			s. d.
1. 720	for Milreas		4 10 $\frac{1}{4}$	6. 9 : 530·900	for St.	at	4 10 $\frac{1}{2}$
2. 964	.. ..		4 10 $\frac{3}{4}$	7. 11 : 905·365	.. ..		4 10
3. 250	.. ..		4 9	8. 1 : 495·200	.. ..		4 8 $\frac{1}{2}$
4. 325	.. ..		4 9 $\frac{1}{2}$	9. 7 : 281·680	.. ..		4 9 $\frac{1}{2}$
5. 436	.. ..		4 6 $\frac{1}{2}$	10. 8 : 211·250	.. ..		4 9

PRUSSIA.

6 Thalers 27 Silb. g. \pm = £1 Sterling.

<i>Exchange :—</i>				<i>Exchange :—</i>			
£ Strl.			Th. S. g.	Th. S. g.			Th. S. g.
1. 540	for Thalers	at	6 27	6. 2890 10	for Strl.	at	6 27 $\frac{1}{2}$
2. 400	.. ..		6 23	7. 2266 20	.. ..		6 25
3. 275	.. ..		6 28 $\frac{1}{2}$	8. 5840 0	.. ..		6 28
4. 360	.. ..		6 27 $\frac{1}{2}$	9. 8800 0	.. ..		6 24
5. 973	.. ..		6 29	10. 9874 15	.. ..		7 0

RUSSIA.

6 Roubles 40 Copecs \pm = £1 Sterling.

<i>Exchange:—</i>				<i>Exchange:—</i>			
£ Strl.		R. Co.		Roub. Co.		R. Co.	
1. 350	for Roubles at	6.40		6. 7320	for Strl. at	6.40	
2. 229	.. ..	6.38		7. 5670	.. ..	6.50	
3. 370	.. ..	6.25		8. 2240	.. ..	6.40	
4. 645	.. ..	6.45		9. 4160.25	.. ..	6.45	
5. 874	.. ..	6.50		10. 1461.02	.. ..	6.38	

SPAIN.

1 Dollar plate \pm = 3s. 1½d.

<i>Exchange:—</i>				<i>Exchange:—</i>			
£ Strl.				Dol. pl.		d.	
1. 306	for Dollars plate at	38½		6. 5920	for Strl. at	36	
2. 450	.. ..	37½		7. 2960	.. ..	36½	
3. 370	.. ..	37		8. 7840	.. ..	38	
4. 219	.. ..	36½		9. 2280	.. ..	37½	
5. 456	.. ..	38		10. 8190	.. ..	37	

SWEDEN.

12 Rixdollars banco \pm = £1 Sterling.

<i>Exchange:—</i>				<i>Exchange:—</i>			
£ Strl.		R. Sk.		Rixd. Sk.		R. Sk.	
1. 470	for Rixdollars at	12 0		6. 7820 16	for Strl. at	12 0	
2. 400	.. ..	12 1½		7. 9650 18	.. ..	11 46	
3. 405	.. ..	12 2½		8. 2507 24½	.. ..	12 1½	
4. 807	.. ..	11 46		9. 11212 24	.. ..	11 47	
5. 936	.. ..	11 47		10. 4751 47½	.. ..	12 1	

TURKEY AND EGYPT.

110 Turkish, 100 Egyptian Piastres \pm = £1 Sterling.

<i>Exchange:—</i>				<i>Exchange:—</i>			
£ Strl.		Pl. Pa.		Piastres. Pa.		Pl. Pa.	
1. 650	for Piastres at	110 0		6. 7649 0	for Strl. at	100 0	
2. 734	.. ..	100 0		7. 8431 0	.. ..	110 0	
3. 920	.. ..	108 25		8. 74557 11½	.. ..	109 15	
4. 346	.. ..	99 20		9. 68281 10	.. ..	109 10	
5. 750	.. ..	109 32		10. 78622 10	.. ..	99 10	

ARBITRATIONS OF EXCHANGE.

1. If the course of exchange between London and Amsterdam be 12 florins 15 cents for £1, and between

Amsterdam and Hamburg 35 florins 50 cents for 40 marks banco; what is the arbitrated rate between London and Hamburg?

2. What is the arbitrated rate between London and St. Petersburg if the course of exchange between London and Paris be 25 francs for £1, and between Paris and St. Petersburg 1 silver rouble for 4 francs 50 cents?

3. A bill bought in London at 25 francs 5 cents, is cashed at Amsterdam at 58 florins for 120 francs; what is the rate of exchange between the two places?

4. What will be the arbitrated rate between London and Amsterdam through Paris if the course of exchange between London and Paris be 25 francs 60 cents for £1, and between Paris and Amsterdam $57\frac{1}{4}$ florins for 120 francs?

5. Bills on Paris, bought in London at 24 francs 50 cents, are negotiated in Hamburg at 186 francs per 100 marks; what is the rate between London and Hamburg?

6. Bills on Turin, bought in London at 30 lire 20 centesimi for £1, are negotiated through Hamburg at 221 lire for 100 marks banco; what is the rate between London and Hamburg?

7. What is the exchange between London and Lisbon when bills on Paris are bought in London at 25 francs 50 cents for £1, and sold in Lisbon at 170 reis per franc?

8. Bills on Berlin are bought in London at 6 dollars 24 groschen for £1, and sold in St. Petersburg at 6 roubles 20 copecs for 6 dollars; what is the rate between London and St. Petersburg?

9. Find the arbitrated rate between London and Berlin, remitting through Vienna, the exchanges being 10 florins 3 kreutzers for £1, and 6 dollars 15 groschen for 10 florins?

10. Bills upon Hamburg are bought at 13 marks $10\frac{1}{2}$ schillings for £1, and sold in Amsterdam at $35\frac{1}{2}$ florins for 40 marks banco, the proceeds are then laid out in bills on Turin at $47\frac{1}{4}$ florins for 100 lire, and these again sold in Paris at 1 per cent. discount; what arbitrated rate do these transactions show between London and Paris?

PERCENTAGES AND AVERAGES.*

1. In 1851 the population of Lancashire was 2,031,236, and in 1861 it was 2,429,620. At what rate per cent. had it increased in the 10 years?

2. The population of Middlesex increased from 1,886,576 in 1851 to 2,206,485 in 1861. At what rate per cent. did it increase in the 10 years?

3. The population of Manchester (including that of the borough of Salford) increased from 401,321 in 1851 to 460,428 in 1861. Find the rate per cent of increase in the 10 years.

4. Find the average of $17\frac{1}{2}$, $25\frac{1}{2}$, $96\frac{2}{3}$, 10, 0, $42\frac{1}{2}$, and 56, and express the fraction decimally.

5. In a government office there is one person receiving £2,000 per annum, two who receive £1,100 each, six who receive £400 each, twelve who receive £200 each, and eighteen who receive £90 each. Find the average income of the persons employed in the office.

6. The populations of three towns in the year 1851 were 20,325, 41,304, and 6117, and in the year 1861 they had increased respectively 9, 10, and 12 per cent. Find the average population of the three towns in 1861.

7. An army lost 18 per cent. of its men by disease and desertion, and then lost 14 per cent. of the remainder in battle; the number then remaining was 84,624. Of how many men did the army originally consist?

8. There are 58 insolvents, three of whom paid 20s. in the pound; eleven 12s. 6d.; nineteen 7s. $1\frac{1}{2}$ d.; seventeen 3s. $4\frac{1}{2}$ d.; two 1s. 6d.; the rest nothing. Find the average dividend.

9. Find the average of $13\frac{1}{2}$, 21, $7\frac{2}{3}$, $\cdot 002\bar{3}$, $3\frac{1}{8}$, 0, $106\frac{1}{2}$, and $57\frac{7}{10}$, and express the fraction decimally.

10. Of 32 selected candidates for the East Indian Civil Service, three were above 20 years of age when they went to India, four above 21, twelve above 22, twelve above 23, and one above 24. Find the average age at which the men went to India.

11. Between the years 1841 and 1851 the population of England increased 14.2 per cent. In the latter year it was 21,121,290. What was it in the former year?

12. A tradesman's annual losses, during 5 years, average

* Most of the questions under this head are taken from the examination papers of the Civil Service Commissioners.

$1\frac{1}{4}$ per cent. on the capital with which he began, and at the end of the 5 years his effects are worth £2531 5s. 0d.; what capital did he begin business with?

13. From the following table :—

Railway Passengers	Great Britain	France	Prussia
1st Class	4743213	2124917	307492
2nd Class	10291749	6172429	1292476
3rd Class	21409217	15473551	2374237

find the proportion per cent. which the whole number of 1st class passengers bears to the whole number of 2nd and 3rd class passengers.

14. A ship 40 miles from shore springs a leak which admits $3\frac{3}{4}$ tons of water in 12 minutes; 60 tons would be sufficient to sink her, but the ship's pumps can throw out 12 tons of water per hour. Find her average rate of sailing that she may reach the shore just as she is beginning to sink.

15. A manufacturer having a capital of £5,000, on which he can realise by hand labour 10 per cent. profit, buys a machine for £1,000, by which his profit on the remainder of his capital is raised to 20 per cent. This machine lasts 5 years. Of how much is he by that time a gainer by the machine, supposing him to draw £300 a year for the support of his family, and to reinvest annually the remainder of his profit in the business?

16. The population of Great Britain in 1851 was 21,121,967, and the increase during the previous half century had been 93·5 per cent. What was the population in 1801?

17. The annual losses of a merchant during 4 years average $3\frac{3}{4}$ per cent. upon his original capital. At the end of 4 years his capital is £2,783 15s. What was it at first?

18. In 1841 the population of Great Britain was 21,476,000, and that of Ireland 7,310,000. In 1851 the former had increased 8·45 per cent., and the latter had decreased 12·5 per cent. Find the increase per cent. in the population of the whole kingdom.

19. The populations of five parishes being 1236, 452, 364, 516, and 3430 respectively, find what the population of

sixth parish must be in order that the average population of the six be 1256·5.

20. A grocer mixes 40 lbs. of sugar at 6d. per lb., 30 lbs. at $5\frac{1}{2}$ d., 45 lbs. at 5d., and 25 lbs. at $4\frac{1}{2}$ d. Find the price per lb. of the mixture.

21. The stuff out of a lead mine at first contains 15·9 per cent. of lead. After washing, by which process the amount of lead is not diminished, the stuff contains 87·45 per cent. of lead. How much rock was washed away out of 216 tons 5 cwt. of the original stuff?

22. The populations of three towns in 1851 were 15,875, 64,575, and 29,185; and in the year 1861 the first two had increased respectively 4 and 5 per cent., and the last had decreased 20 per cent. Find the increase or decrease per cent. of the total population of the three towns.

23. Find the average of $16\frac{1}{4}$; $24\frac{1}{2}$; 12; $95\frac{5}{8}$; 0; 52; $4\frac{1}{8}$, and 1·625, and express the fraction decimally.

24. Suppose the number of persons employed on the railways are respectively:—

Year.	England.		Scotland.		Ireland.	
		Miles.		Miles.		Miles.
1862	55,331	5433·9	8,271	961·4	3,999	680·4
1863	66,267	7544·2	8,979	977·9	5,163	786·9

Hence find the average number of men per mile employed on railways in the whole United Kingdom (1) in 1862, (2) 1863.

25. The average weekly receipts of a railway company for the year 1863 were £1,506 10s. What dividend was paid to the shareholders on a capital of £1,200,000, after deducting 45 per cent. for expenses?

DIVISION INTO PROPORTIONAL PARTS.*

1.	Divide 240	into parts proportional to the numbers	1, 2, 3
2.	" 80	" " "	4, 8, 12, 16
3.	" 30	" " "	5, 8, 12
4.	" 90	" " "	$\frac{1}{3}, \frac{2}{4}, 1, 1\frac{1}{2}$
5.	" 55	" " "	3, 8, 12, 15
6.	" 100	" " "	$\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$
7.	" 4000	" " "	$\frac{2}{3}, 1, 1\frac{1}{3}$
8.	" 60	" " "	1, $\frac{2}{3}, \frac{2}{5}$
9.	" 16	" " "	1, 2, 4, 6
10.	" 1000	" " "	3, 5, 8
11.	" 6	" " "	$\frac{1}{2}, \frac{5}{8}, \frac{7}{8}$
12.	" 1900	" " "	$\frac{1}{10}, \frac{1}{2}, \frac{2}{4}, 2$

13. Divide 80 guineas amongst A, B, and C, so that their proportions may be as 7, 11, and 14 respectively.

14. Divide £24 16s. 10d. into two parts, which shall be in the proportion of the numbers 9 and 13.

15. Our silver coinage is made of an alloy of 37 parts silver to 3 parts copper; what weight of each metal is there in silver coins weighing 576 lbs.?

16. Divide £5500 amongst 4 persons, A, B, C, and D, in the proportions of $\frac{1}{2}, \frac{1}{3}, \frac{1}{4},$ and $\frac{1}{5}$.

17. If cannon are cast out of an alloy of 11 parts aluminium to 100 of copper, how much of each metal is there in an Armstrong gun weighing 71 cwt. 1 qr. 12 lbs.?

18. Gunpowder is made of 75 parts saltpetre, 10 parts sulphur, and 15 parts charcoal; how much is there of each in 1 ton of powder?

19. My gas bill amounts to £5 4s. for the year, while the consumption has been 8000, 6500, 2250, and 9250 ft. in the respective quarters; what was the cost of gas each quarter?

20. Divide £90,000 amongst A, B, C, and D, so that A's share : B's share :: 1 : 2, B's : C's :: 3 : 4, and C's : D's :: 4 : 5.

ALLIGATION MEDIAL.†

1. If there be mixed 2 gallons of wine at 14s. per gallon, 1 at 12s., 2 at 9s., and 4 at 8s., what will a gallon of the mixture be worth?

* The pupil is recommended to work through this rule before commencing Fellowship.

† The pupil will perceive that the examples under this head involve nothing more than a calculation of "Averages."

2. A tea merchant mixes 24 lbs. of tea at 6s. a pound with 20 lbs. at 5s., and 30 lbs. at 4s. 6d.; what is the value of a pound of the mixture?

3. If a mixture be made of 4 cwt. of sugar at 56s. per cwt. with 7 cwt. at 43s., and 5 cwt. at 37s., what is the value of 2 cwt. of this mixture?

4. A tobacconist mixes 30 lbs. of snuff at 9d. a lb. with 60 lbs. at 1s. 2d., and $24\frac{3}{4}$ lbs. at 2s.; what is a pound of the mixture worth?

5. $55\frac{1}{2}$ gallons of Canary at 2s. $8\frac{1}{2}$ d. per quart, $48\frac{3}{4}$ of Bucellas at 1s. $7\frac{1}{2}$ d., and $50\frac{1}{4}$ gallons of Rhenish at 2s. 2d. were mixed together; what is a quart of the mixture worth?

6. A composition being made of 10 gallons at 7s., 18 gals. at 8s. 6d., and 15 gals. at 5s. 10d.; what is a gallon of the mixture worth?

7. Let 4 cwt. of sugar at £2 18s. per cwt., 7 cwt. 2 qrs. at £2 13s. per cwt., 5 cwt. 1 qr. at £1 19s. per cwt., and 3 cwt. 3 qrs. at £1 14s. per cwt., be mixed together; what is the worth of 1 cwt. of this mixture?

8. What is the average price per quarter of 18 qrs. of barley at 60s. a quarter, 25 at 40s., 36 at 44s., 16 at 48s., and 15 at 54s.?

9. What is the worth per pound of a mixture of 50 lbs. of tobacco at $11\frac{1}{2}$ d. per lb. with 40 lbs. at 14d. per lb., 27 lbs. at 2s. 6d. per lb., and 87 lb. at 3s. per lb.?

10. If a mixture be made of 27 lb. of cloves at 6s. a pound with 15 lbs. at 2s. 6d., and 10 lbs. at 2s. 2d., what is a pound of it worth?

11. A corn dealer shoots together 40 bushels of corn at 4s. a bushel, 10 bushels at 6s., 30 bushels at 5s., and $2\frac{1}{2}$ quarters at 24s. a quarter; what are 10 bushels of the mixture worth?

12. What is the fineness of a composition of gold in which are mixed 7 lbs. of gold at 22 carats fine, with 10 lbs. at 21 carats fine, and 19 lbs. at 19 carats fine?

13. A butcher has 150 lbs. of mutton at 6d. per lb., 970 lbs. of beef at $7\frac{1}{2}$ d., 420 lbs. of pork at $5\frac{1}{2}$ d., 540 lbs. of veal at $6\frac{1}{2}$ d.; at what price per lb. may he average the whole?

14. A mixture of metals is made, 50 tons costing £4 8s. per ton, with 64 tons at £3 19s., 81 at £3 5s., and 12 at £2 17s. 6d.; what is the worth of the mixture per ton, allowing 10 per cent on the cost price for labour?

15. A merchant mixes 2 cwt. of West Indian sugar at 4d.

per lb. with 3 cwt. 2 qrs. of Mauritius, at $3\frac{1}{2}$ d., and 184 lbs. of beet root sugar at 2d.; he puts on a profit of 10 per cent.; at what rate per lb. must he sell the sugar?

ALLIGATION ALTERNATE.

1. What quantity of each of two sorts of sugar, one at 5d. per lb. and the other at 11d., will, when mixed, be worth 7d. per lb.?

2. If spirits at 16s., 18s., and 23s. per gallon be mixed, so that the mixture is worth 20s. per gallon, what quantity of each must be taken?

3. Wines at 14s., 12s., 9s., and 8s. per gallon are mixed; what quantity of each sort may be put into the mixture that it may be sold at 10s. per gallon?

4. How many pounds of tea at 2s. 8d., 3s. 4d., 3s. 8d., and 4s. per lb., must be taken to form a mixture worth 3s. 6d. per lb.?

5. How must sugars at 4d., 6d., and 10d. per lb. be mixed so as to be sold at 8d. per lb.?

6. In order to get a mixture worth 18s. a gallon, it is desired to mix wines at 14s., 19s., 15s., and 22s. a gallon; how many gallons of each must be taken?

7. Out of four sorts of gold, namely, of 24, 22, 20, and 15 carats fine respectively, a mixture of 63 ounces of 17 carats fine is made; how much of each sort is taken?

8. A merchant has a hogshead of wine worth 2s. a quart, which he mixes with three other sorts of 11d., 16d., and 23d. a quart respectively; what quantity of each must be mixed with the hogshead to make a quart worth 18d.?

9. A rectifier wishes to mix 80 gallons of brandy, at 12s. per gallon, with another kind at 7s. per gallon, and a third at 4s.; what quantity of each sort must be taken to make a mixture worth 8s. per gallon?

10. A distiller would mix 48 gallons of rectified spirit, at 18s. per gallon, with spirits at 10s. 6d. and 6s. per gallon; what quantity of each sort must be taken that the mixture may be worth 12s. per gallon?

11. A corn-chandler wishes to mix corn at 4, 3, and 2 shillings per bushel, with 24 bushels at 1s. 6d. per bushel, and to sell the mixture at 3s. 4d. per bushel; how many bushels of each sort must he take?

12. How many gallons of water must be mixed with wine worth 3s. a gallon so as to fill a vessel of 100 gallons, and that a gallon may be sold for 2s. 6d.?

SINGLE POSITION.

1. A's age is double that of B and B's triple that of C, and the sum of their ages is 140 years. What is each person's age?

2. What sum of money must be divided amongst 4 men so that the first shall have $\frac{1}{3}$ of it, the second $\frac{1}{4}$, the third $\frac{1}{6}$, and the fourth the remainder, which is £28?

3. What number is that to which if you add $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$ of the whole, the sum will be 18?

4. A, B, and C buy an estate costing £2700. B engages to pay twice as much as A, and C three times as much as B. How much must each pay?

5. A cistern containing 60 gallons is emptied by three unequal taps. The first tap would empty it in 1 hour, the second in 2, the third in 3. How long would they take to empty it all running together?

6. A lady, who has a certain sum in her purse, pays half of the sum to her draper, half of what is left to her milliner, and then has £8 15s. left. How much had she at first?

7. A gentleman bought a chaise, horse, and harness for £60. The horse came to twice the price of the harness, and the chaise to twice the price of the horse and harness. What did he give for each?

8. £212 14s. 7d. are to be divided amongst a captain, 4 men, and a boy. The captain is to have a share and a half, each man a share, and the boy $\frac{1}{3}$ of a share. How much will each receive?

9. A, B, and C make a purchase jointly to the amount of £36, agreeing that B shall pay $\frac{1}{3}$ more than A, and C $\frac{1}{4}$ more than B. What must each man pay?

10. If A can do a piece of work in 7 days, B in 5, and C in 6; how long would they be doing it all working together?

11. A, B, and C trade together and gain £100, of which A takes a certain sum, B twice as much as A, and C thrice as much as B; how much will each get?

12. If the third, the fourth, and the fifth part of the money in my purse amount to £94, how much have I?

13. What number is that to which if $\frac{1}{2}$ and $\frac{1}{3}$ of itself be added, and then $\frac{1}{4}$ of the sum be subtracted, the remainder shall be 106?

14. A, B, and C put in money together, and gained £100,

of which A took a certain sum, B twice as much, and C thrice as much as B; what did each take?

15. A boy having a certain number of marbles said that if the half, third, and fourth of them were added together they would make 65; how many had he?

16. A sum of money was put out at simple interest for 10 years at 6 per cent., at the expiration of which time the lender received £500 for principal and interest together. What was the sum originally lent?

17. If $\frac{1}{5}$ of an army division were killed in battle, $\frac{1}{10}$ taken prisoners, $\frac{1}{10}$ died of sickness, and 4,000 were still left, of how many men was the division at first composed?

18. Out of a cask of water, of which $\frac{1}{2}$ had been spilled, 10 gallons were drawn, and it was then $\frac{3}{4}$ full. How much did it hold?

19. A lost at play, first the 6th part, and, secondly, the 10th part of a certain sum of money; he then gained the third part of the same sum; supposing that his gain exceeded his loss by £3, what was the sum?

20. Required a number to which if one-half of itself, one-third of that half, and one-fourth of that third be added, the sum will be 287.

DOUBLE POSITION.

1. Divide £100 amongst A, B, and C, so that B may have £3 more than A, and C £4 more than B: how much will each have?

2. What number is that, which, being multiplied by 3, the product increased by 4, and the sum divided by 8, the quotient will be 32?

3. The pier of a bridge is $\frac{1}{3}$ in the soil, $\frac{1}{4}$ in the water, and 10ft. above the water: what is the entire length of the pier?

4. A gentleman has a brougham worth £150, and two horses: if the first horse be put into the brougham the horse and carriage are together worth three times as much as the second horse alone; but if the second horse be put into the brougham the horse and carriage are then worth together double the value of the first horse: what is the value of each horse?

5. A, B, and C join in building a sloop costing £1,000: of this A paid a certain sum, B £100 more, and C as much as the two together: what did each pay?

6. A robs an orchard, and running away is caught by B, whom he bribes by giving him half the apples he had stolen, but B returns him 10 apples; going further A meets C, and is forced to give him half his remaining apples, but C returns him 4; still going on he meets D, who forces from him half of the apples remaining, but returns 1: A gets away with the remaining apples; how many were there left?

7. A lady distributing money amongst some poor people finds she wants 10s. to be able to give 5s. to each, so she gives each 4s. only, and finds after the distribution she has 5s. left: required the number of shillings and of poor people.

8. A is 18 years old; B's age is equal to A's and the half of C's, and C is as old as A and B together: what are the ages of B and C?

9. An animal with a head 9 inches long has a tail as long as his head and half his body, and a body as long as both head and tail: what is its entire length?

10. A mathematician being asked the time, replied, "The day is now 16 hours long, and the sun rises at 4 o'clock; if you add half the hours that have passed since the sun rose to three quarters of those which must elapse before the sun sets, you will have the exact time of day:" what was it?

11. A wine merchant has wines at 9s. and 13s. a gallon: how many gallons of each must he take to make a mixture of 100 gallons worth 12s. a gallon?

12. A machinist bought a shop with steam engine and tools for £500; now he paid four times the price of the tools for the engine, and five times the price of the engine for the shop: what was the cost of each?

13. A person gave 2d. a piece amongst several poor children, and had 4d. left: he would have given each 3d, but wanted 10d. to be able to do it: what was the number of children?

14. A, B, and C make a total gain of £780. If you add A and B's gains together, and subtract C's from the sum, there remains A's gain + £82; but if you add B and C's gains together, and from the sum subtract A's, there remains C's gain—£43; what was the gain of each?

ARITHMETICAL PROGRESSION.

1. The first term of an arithmetical series is 3, the last 15, and the number of terms 13; what is the sum of the series?

2. When the first term is 6, the last 12, and the number of terms 9, what is the sum of the series?

3. The first term is 4, the last 22, and the number of terms 7; find the sum of the series.

4. The first term is 10, the last 70, and the number of terms 21; find the sum of the series.

5. The first term is 3, the last 139, and the number of terms 35; find the sum of the series.

6. The first term is $\frac{3}{4}$, the last $2\frac{3}{4}$, and the number of terms 7; find the sum of the series.

7. The first term is $\frac{7}{12}$, the last $2\frac{1}{2}$, and the number of terms 24; find the sum of the series.

8. The first term is 3, the last 4, and the number of terms 9; find the sum of the series.

9. The first term is 3, the last 30, and the number of terms 10; find the sum of the series.

10. The two extremes of an arithmetical series are 6 and 501, and the number of terms 100; find the sum.

11. The two extremes of an arithmetical series are $\frac{1}{2}$ and $4\frac{1}{2}$, and the number of terms 5; find the sum of the series.

12. The two extremes are 2 and 52, and the number of terms 11; find the sum of the series.

13. The two extremes are 5 and 7, and the number of terms 6; find the sum of the series.

14. A heavy body, when falling from a place of rest to the earth, falls through $16\frac{1}{4}$ feet the first second, $48\frac{1}{4}$ feet the next second, $80\frac{1}{4}$ the next, &c. Through what space would it fall in six seconds, the space fallen through in the sixth or last second being $176\frac{1}{4}$ feet?

15. The first term of an arithmetical series is 3, the last 30, and the number of terms 10; find the common difference.

16. The two extremes of an arithmetical series are $2\frac{1}{2}$ and $6\frac{1}{2}$, and the number of terms 6; find the common difference.

17. The first term is 11, the last $14\frac{2}{3}$, and the number of terms 8; find the common difference.

18. Insert 5 arithmetic means between 14 and 32.

19. Insert 7 arithmetic means between 3 and 4.

20. Insert 5 arithmetic means between 5 and 6.

21. When the first term of an arithmetical series is 7, the last 40, and the number of terms 12, what is the 9th term?

22. The first term of an arithmetical series is $1\frac{1}{2}$, the last $42\frac{3}{4}$, and the number of terms 16; find the 5th term.

23. When the first term is $104\frac{2}{3}$, the last 8, and the number of terms 59, what is the 55th term?

24. The extremes of an arithmetical series being 1 and 34, and the common difference 3, what is the number of terms?

25. The sum of an arithmetical series is 2·748, the number of terms 60, and the first term, ·034; find the last term.

26. The sum of an arithmetical series is $2515\frac{1}{2}$, the number of terms 27, and the first term $80\frac{1}{2}$; find the last term.

27. The first term of an arithmetical series is $\frac{2}{3}$, the sum $303\frac{2}{3}$, and the number of terms 27; find the last term.

28. The sum of an arithmetical series is 1,924, the number of terms 26, and the last term 121; find the first term.

29. The sum of an arithmetical series is 22, the number of terms 4, and the first term $3\frac{1}{3}$; find the last term.

30. How many times does the hammer of a common clock strike in three days, of 24 hours each?

31. A railway train passes over 4ft. in the first second, and over 88ft. in the 60th second; how far does it travel in the first minute, supposing the speed increases per second in an arithmetical progression?

32. If 100 stones are laid in a straight line at the distance of 2 yards from each other, and a basket is placed 2 yards from the first stone, what distance will a man travel in gathering these stones, supposing he collects them one by one, returning with each to the basket?

33. The two extremes of an arithmetical series are $\frac{2}{3}$ and $77\frac{2}{3}$, and the common difference $\frac{1}{4}$; find the number of terms.

34. In Venice the clocks strike from 1 to 24; how many times does the hammer of a Venetian clock strike in 24 hours?

35. A butcher buys 32 oxen; for the first he pays 15s., and for the others he is to pay in arithmetical progression, so that for the last he is to pay £38; what does he pay for the whole drove?

36. A railway train moves the first minute at the rate of 10 miles an hour; each minute its speed increases by $2\frac{1}{2}$ miles; at what rate per hour will it travel in 10 minutes?

37. What debt can be discharged by 10 instalments, in arithmetical progression, supposing the first payment to be £10 and the last £93 5s?

38. A man has to discharge a debt in one year by weekly payments in arithmetical progression; the first payment is £2 be 1s. and the last £7 14s.; find the debt.

GEOMETRICAL PROGRESSION.

1. The first term of a geometrical series is 4, the last 1024, and the common ratio 2; find the sum of the series.
2. The first term is 9, the last 6561, and the common ratio 3; find the sum of the series.
3. The first term is 3, the last 1536, and the common ratio 2; find the sum of the series.
4. The first term of a geometrical series is $\frac{1}{3}$, the last 81, and the common ratio 3; find the sum of the series.
5. The two extremes of a geometrical series are $\frac{1}{9}$ and 9, and the common ratio 3; find the sum.
6. The two extremes of a geometrical series are 2 and 4096, and the number of terms 12; find the common ratio.
7. The first term is 54, the last $\frac{37}{3}$, and the number of terms 7; find the common ratio.
8. The first term is 5, the last 1280, and the number of terms 5; find the common ratio.
9. The first term is 3, the last $\frac{1}{3 \cdot 9 \cdot 3}$, and the number of terms 6; find the common ratio.
10. Insert 3 geometrical means between 2 and 32.
11. Insert 3 geometrical means between 37 and 2997.
12. Insert 2 geometrical means between 1 and 100.
13. Insert 3 geometrical means between $\frac{1}{3}$ and 128.
14. Insert 4 geometrical means between $\frac{1}{3}$ and 81.
15. Find the 5th term of the series 3, $\frac{1}{3}$, $\frac{1}{9}$, &c.
16. Find the 6th term of the series $3\frac{3}{8}$, $2\frac{1}{4}$, $1\frac{1}{2}$, &c.
17. Find the 5th term of the geometrical series 7, 17·5, 43·75, &c.
18. Find the 4th term of the series, 12, $1\frac{1}{3}$, $\frac{4}{27}$, &c.
19. Find the 7th term of the series $3\frac{1}{4}$, 7, 14, &c.
20. The two extremes of a geometrical series are $\frac{1}{2}$ and $369\frac{1}{2}$, and the common ratio 3; find the number of terms.
21. The first term is $\frac{1}{16}$, the last 19440, and the common ratio 6; find the number of terms.

22. The two extremes of a geometrical series are $\frac{1}{4}$ and $\frac{1}{31\frac{1}{2}}$, and the common ratio $\frac{1}{4}$; find the number of terms.

23. The two extremes of a geometrical series are 3 and $15\frac{3}{16}$, and the common ratio $1\frac{1}{2}$; find the number of terms.

24. The common ratio of a geometrical series is 3, the number of terms 9, and the first term 3; find the last term.

25. The common ratio is 3, the number of terms 7, and the first term 4; find the last.

26. The common ratio of a geometrical series is 4; the number of terms 10, and the last term 131072; find the first term.

27. Find the sum of the geometrical series 9, 6, 4, &c., to 8 terms.

28. Find the sum of 100, 40, 16, &c., to infinity.

29. Insert one geometrical mean between 9 and 16.

30. Find the sum of $\frac{1}{2}$, 1, $\frac{1}{2}$, &c., to infinity.

31. The first term is 3, the last $15\frac{3}{16}$, and the common ratio $1\frac{1}{2}$; find the sum of the series.

32. Find the sum of the infinite series $\frac{1}{3}$, $\frac{1}{9}$, $\frac{1}{27}$, &c.

33. Find the sum of the infinite series $3\frac{3}{8}$, $2\frac{1}{4}$, $1\frac{1}{2}$, &c.

34. Find the value of the circulate $\cdot\dot{3}$, that is, the sum of the infinite geometrical series $\frac{3}{10}$, $\frac{3}{100}$, $\frac{3}{1000}$, &c.

35. Find the value of the circulate $\cdot\dot{4}$, that is, the sum of the infinite geometrical series $\frac{4}{10}$, $\frac{4}{100}$, $\frac{4}{1000}$, &c.

36. Find the value of the circulate $\cdot\dot{463}$, that is, the sum of the infinite series $\frac{463}{1000}$, $\frac{463}{1000000}$, $\frac{463}{1000000000}$, &c.

37. A man buys 12 lbs. of tea, and he agrees to pay 3d. for the first lb., 9d. for the second, 2s. 3d. for the third, and so on in geometrical progression. How much did he pay for the last lb., and how much for the whole?

38. A sum of money is to be divided among 6 persons; the first is to have £7, the second £17 10s., the third £43 15s., and so on in geometrical progression. What does the last receive, and what is the total sum distributed?

39. A gentleman sells 8 horses; for the first he agrees to receive £1, for the second £3, for the third £9, and so on. What is the total sum for which he sells the horses?

40. A debt of £62 10s. is paid by instalments, the first instalment being £1 11s. 3d., the second £4 13s. 9d., the third £14 1s. 3d., and so on. Find the number of payments.

PERMUTATIONS AND COMBINATIONS.

1. Required the number of permutations that can be formed from 6 things taken two and two together.
2. Required the number of permutations that can be formed from 8 things taken three and three together. Also the number taken four and four together.
3. Find the number of permutations that can be formed of 10 things taken all together.
4. Required the number of permutations that can be formed from 5 things taken all together.
5. How many changes can be rung on 9 bells? How many on 12 bells?
6. In how many different positions can 7 persons be arranged at a table? In how many can 5 persons?
7. In how many different ways can a class of 14 boys stand up to read?
8. Required the number of permutations that can be formed from the letters of the word "Glasgow" taken all together.
9. Required the number of permutations that can be formed out of the letters of the word "inconceivably."
10. Required the number of combinations that can be formed from 24 things taken four and four together.
11. How many combinations are there of 52 things taken 13 together?
12. Find the number of combinations of 100 things taken 98 together.
13. What is the total number of combinations of 10 things taken 7 together?
14. Five gentlemen met at an inn, and offered the landlord £20 if he would lodge and board them so long as they could sit every day at dinner with him in a different order, to which he agreed. How long did they stay?
15. Find the number of combinations of 10 things taken 4 together.
16. A company of soldiers consists of 36 men, and 5 are chosen every night as sentinels. On how many nights may a different set of the 5 sentinels be chosen?
17. Out of 17 consonants and 5 vowels how many different words may be formed, each consisting of 2 vowels and 3 consonants?
18. How many different sums can be formed with a

guinea, a sovereign, a crown, a half-crown, a shilling, a sixpence, a penny, and a farthing?

19. How many words of 6 letters may be formed out of the 24 letters of the alphabet, with 2 of the 5 vowels in each word?

20. Find the number of permutations that can be formed out of the letters of the word "Museum;" also out of the letters of the word "Mississippi."

LOGARITHMS.

The following questions are to be worked from any good book of logarithmic tables.

Find the logarithm of :—

1. 56; 364; 814; and 699.
2. 901; 286; 2; and 6.
3. 2746; 4792; and 6·1953.
4. 47·5384; 457; and 7·384.
5. 3·56775; and 46874.

Find the numbers corresponding to the following logarithms :—

6. 3·979832 and 1·662758.
7. 2·147522 and 3·774240.
8. 1·749156 and 2·871427.
9. 2·551724 and 1·805161.
10. 0·569374 and 1·926857.
11. 2·763503 and 2·959185.
12. 5·314782 and 1·282169.

Multiplication and Division by logarithms.

1. Find the product of 75·825 and 84·75, and of 3·71 and 84·5.
2. Find the product of 13·1624 and 29·25, and of 9·77386 and 47·4.
3. Find the continued product of 356·225, ·6385, ·07425, and 8·42725.
4. Find the product of ·00352 and ·864, and of ·0925 and 73·5.
5. Divide 9·7128 by ·456, and 9 by 75.
6. Divide 8964 by 3·84, and 62·78 by 71·6.
7. Divide ·128 by ·00256, and 235·08 by ·072.
8. Find the continued product of 4100, 7·319, ·03, 439257, and ·0000045879.

9. Find the value of

$$\frac{38067 \times .000507 \times 1.3596}{.5498 \times 300 \times .0086735}$$

10. Find the value of

$$\frac{281 \times 2.71828 \times .09}{84000 \times .7301 \times .0073}$$

Involution and Evolution by logarithms.

1. Find the 3rd power of 32; also of .009.
2. Find the 4th power of .0437, and the 7th power of 7.142.
3. Find the 6th power of 1.055, and the 9th power of .0375.
4. What is the square root of .5329? Of 2625?
5. Find the cube root of 17; also of .041063625.
6. What is the 8th root of .02405, and the 10th root of 5386.25?
7. Find the value of

$$\left(\frac{39 \times 7 \times 4}{19 \times 9 \times 17} \right)^{\frac{1}{5}}$$

8. Find the 70th power of 1.0009.
9. What is the 19th root of .00123456, and the .065 root of 1.6235?
10. Find the value of

$$\left\{ \frac{(15.92)^{\frac{1}{2}} \times (.0182)^{\frac{1}{3}}}{.00526 \times (196)^{\frac{1}{4}}} \right\}^{\frac{1}{2}}$$

11. Find the value of

$$(\text{£}32 \text{ 16s. } 7\frac{3}{4}\text{d.}) \times (1.015)^{.50}$$

BILLS OF PARCELS, OR INVOICES.

1. London, May 1st, 1864.
Mr. H. Dawson.

Bought of Williams and Co.

			s.	d.	
6 lbs. tea	at	. .	3	8	per lb.
6 " "	"	. .	4	4	"
9 " sugar	"	. .	0	6 $\frac{1}{2}$	"
12 " "	"	. .	0	4 $\frac{3}{4}$	"
18 " rice	"	. .	0	3	"
3 " mustard	"	. .	1	8	"

2. Manchester, May 1st, 1864.

Mr. Edward Johnson.

Bought of Forbes Brothers.

		s.	d.	
28 yards of calico	at	0	7 $\frac{1}{2}$	per yard.
21 " black silk	"	4	2	"
12 pairs of gloves	"	2	9	" pair.
2 umbrellas	"	16	6	each.
3 shawls	"	19	0	"
4 parasols	"	9	9	"

3. Lincoln, May 6th, 1864.

Mr. George Hodges.

Bought of Peter Thompson.

		s.	d.	
3 quarters of wheat,	at	7	9	per bush.
12 bushels of oats	"	3	2	"
18 " barley	"	4	10	"
25 $\frac{1}{2}$ " rye	"	4	4	"
17 $\frac{1}{4}$ " beans	"	4	10	"
28 " peas	"	4	8	"

4. Liverpool, April 30th, 1864.

Mr. Walters.

Bought of William Russell.

		s.	d.	
$\frac{1}{2}$ cwt. cheese	at	0	7 $\frac{3}{4}$	per lb.
127 lbs. bacon	"	0	6 $\frac{1}{2}$	"
40 " fresh butter	"	1	2 $\frac{1}{8}$	"
20 " salt butter	"	0	9	"
19 $\frac{1}{2}$ " lard	"	0	7	"
120 eggs	"	0	9	per doz.

5. Newcastle, May 2nd, 1864.

Mr. Charles Wilkins.

Bought of Benjamin Noble.

		£	s.	d.	
4 bedsteads	at	2	12	6	each
12 chairs	"	1	5	6	"
2 sofas	"	4	4	0	"
3 tables	"	2	15	0	"
25½ yards carpet	"	0	3	9	per yard.
18¾ " " "	"	0	2	6	"

6. Glasgow, May 5th, 1864.

Mr. Wm. Turner.

Bought of Findlater and Mackie

		s.	d.	
12 doz. port wine	at	52	0	per doz.
8 " sherry	"	38	0	"
14 " claret	"	42	0	"
10 " hock	"	73	0	"
8 gals. brandy	"	28	0	per gal.
12 " gin	"	14	6	"

Write out, in the form of a bill or invoice, each of the following exercises, specifying the amount of each separate item, and giving the total amount of each bill:—

7. London, April 30th, 1864.—Mrs. Wm. Burgess, bought of Hitchcock and Rogers: 18 yds. of cambric, at 3s. 9d.; 44½ yds. of silk, at 4s. 2d.; 16 yds. of ribbon, at 7¼d.; 18 pairs of stockings, at 1s. 10d.; 15½ yds. of lace, at 8s. 9d.; 12 pairs of gloves, at 3s. 3d.

8. Manchester, May 5th, 1864.—Mr. Andrew Brown, bought of Henry Middleton and Son: 9 lbs. of black tea, at 4s. 8d.; 6 lbs. of green tea, at 5s. 10d.; 10 lbs. of ginger, at 1s. 9½d.; ¼ cwt. of soap, at 4¼d. per lb.; 18 lbs. of starch, at 6¾d.; 33 lbs. of sugar, at 6½d.

9. Dublin, May 2nd, 1864.—Mrs. Howard, bought of Richard Parker: 19½ lbs. of beef, at 7¾d.; 7 lbs. of suet, at 7½d.; 13½ lbs. of mutton, at 8d.; 19 lbs. of veal, at 7¼d.; 3 hams, each 22½ lbs., at 6½d. per lb.; 10½ lbs. of pork, at 7½d.

10. Birmingham, May 4th, 1864.—Mr. Evans, bought of Hamilton and Co.: 3 dozen knives, at 22s. 6d. per dozen;

4½ dozen spoons, at 1s. 3d. each; 4 sets of fire-irons, at 9s. 9d. per set; 4 fenders, at 19s. 10d.; 4½ dozen plated forks, at 1s. 11d. each; 3 sets of carvers, at 13s. 6d. per set.

11. London, May 12th, 1864.—Mr. Green, bought of George Winter and Son, 5 reams of letter paper, at 12s. 6d.; 1,500 envelopes, at 6s. 6d. per 1,000; 2½ reams of note paper, at 3d. per quire; binding 5 volumes of Macaulay's works, at 2s. 10d. per volume; printing 2,000 circulars, at 2s. 4d. per 100; 50 quill pens, at 12s. 6d. per 100.

12. Manchester, May 2nd, 1864.—Wm. Boyd, Esq., bought of Silverdale and Co.: 8 silver table spoons, weighing 24½ oz., at 6s. 6d. per oz.; 12 tea spoons, weighing 12½ oz., at 6s. 10d. per oz.; 12 silver forks, weighing 17½ oz., at 7s. 6d. per oz.; 2 sugar tongs, at 22s. 6d. each; 4 salt spoons, at 5s. 6d. each.

13. Manchester, May 1st, 1864.—Mr. Brown, bought of William Jones: 24 lbs. of refined sugar, at 8½d. per lb.; 59 lbs. Patna rice, at 2½d.; 15½ lbs. of raisins, at 5½d.; 19½ lbs. of black tea, at 4s. 9d.; 11 lbs. of coffee, at 1s. 7d.; and 8 lbs. of soap, at 6½d.

14. Stockport May 3rd, 1864.—Mr. Robinson, bought of John Smith: 59 yards of calico, at 7½d. per yard; 18½ yds. of glacé silk, at 5s. 8d.; 14½ yds. of Welsh flannel, 1s. 1½d.; 120 yards of Kidderminster carpet, at 3s. 8½d.; 63 pairs of blankets, at 15s. 9d. per pair; 15 yds. of superfine broad cloth, at 17s. 6d. per yard.

15. Dublin, May 2nd, 1864.—Mr. Hall, bought of Thomas Dignum: 15 gross of pint bottles, at 12s. 6d. per gross; 69 gross of quarts, at 16s. 3½d.; 8 dozen 3-gallon wicker-covered, at 1s. 9½d. each; 190 gross of ginger beer bottles, at 5s. 11d. per gross; 500 penny inks, at 3½d. per dozen; crate, cord, and straw, £1 5s. 11d.

16. Leicester, March 25th, 1864.—Mr. Kenworthy, bought of C. J. Price: 18 lbs. of roasting beef, at 7¾d. per lb.; 29 lbs. of mutton, at 8½d.; 16 lbs. of veal, at 10d.; 47 lbs. of pork, at 9½d.; 85 lbs. of boiling beef, at 6½d.; and 48 lbs. of lamb, at 7d.

17. Manchester, May 1st, 1864.—Mr. Jones, bought of J. Carter: 88 lbs. of best wheaten bread, at 1½d. per lb.; 44 lbs. of cheese, at 5d.; 39½ lbs. of gingerbread, at 6½d.; 87½ lbs. of biscuits, at 5d.; 32 lbs. of bacon, at 9½d.; and 84 lbs. of butter, at 1s. 1½d.

18. London, May 1st, 1864.—Mr. Forrest, bought of Fell Brothers: 11½ lbs. of isinglass, at 4s. 4d. per lb.; 19½ lbs. of

cocoa, at 1s. 8d. ; 22 lbs. of white lead, at 6½d. ; 85 lbs. of sulphate of iron, at 5¾d. ; 39 lbs. of sassafras chips, at 3½d. ; and 99 lbs. of carraway seeds, at 5½d.

19. Macclesfield, June 1st, 1864.—Mr. Percival, bought of J. Falkner : 89 yards of calico, at 9½d. per yard ; 47 yards of coloured silk, at 3s. 11½d. ; 38½ yards of chintz, at 8½d. ; 44½ yards of lining, at 6½d. ; 49 yards of ribbon, at 5½d. ; and 38 yards of insertion, at 1s. 1½d.

20. Birmingham, March 5th, 1864.—Mr. Watson, bought of Thos. Smith : 1,009 seedling firs, at 3d. each ; 2,468 apple trees, at 9d. ; 7,001 flowering currants, at 1s. 3½d. ; 1,725 young oaks, at 4½d. ; 6,154 scarlet thorns, at 10½d. ; 4,171 cherry trees, at 1s. 2½d.

21. London, May 1st, 1864.—Mr. C. J. Holmes, bought of J. Harmer : 14 dozen knives, at 8¼d. each ; 2½ dozen razors, at 2s. 2d. each ; 4 dozen gimlets, 4¾d. each ; 12 dozen dessert knives, 12s. 5d. per dozen ; 1½ dozen table knives, £1 17s. 0d. per dozen ; 8 doz. brad awls, at 7½d. each ; and 12 coal-vases, at 17s. 3¾d. each.

22. Liverpool, April 8th, 1864.—Mr. Knowles, bought of Findlater and Co. : 10 gallons of whisky, at 12s. 2¾d. per gallon ; 25 gallons of British brandy, at 18s. 10d. per gallon ; 19 gallons golden sherry, at 23s. 4½d. per gallon ; 5 dozen of champagne, at 89s. 10½d. per dozen ; 23 dozen of claret, at 41s. 5½d. per doz. ; and 18 doz. of Bucellas, at 39s. 11d. per doz.

23. Manchester, April 12, 1864.—Mr. Symes, bought of Thos. Brown : 13 brushes at 1s. 2¾d. each ; 35 taps, 6½d. each ; 29 baskets, at 10d. each ; 8 hampers, at 2s. 1½d. each ; 17 carriage bags, at 7s. 4d. each ; and 2 dozen yard brooms, at 12s. 11½d. per dozen.

24. Wolverhampton, April 16th, 1864.—Mr. Burton, bought of James Perks : 57 feet of boards, at 5½d. per foot ; 280 feet of oak planking, at 3½d. ; 79 feet mahogany, at 2s. 1d. ; 136 feet of deal framing, at 1s. 10½d. ; 95 feet of boxwood, at 2s. 9d. ; and 9 men's time for 17 days, at 2s. 4½d. each per day.

25. Glasgow, April 29th, 1864.—Mr. Semmes, bought of J. T. Laird : 9 yds. 5 ft. 80 in. of building land, at £1 0s. 6½d. per square yard ; 22 yards 7 feet 100 in., at £2 1s. 3½d. ; 24 yards 3 feet 130 in., at £2 3s. 4d. ; 72 yards 1 ft. 140 in., at 12s. 9½d. ; 28 yds. 0 ft. 63 in., at 5s. 10¾d. ; and 54 yards 2 ft. 35 in., at £2 10s. 5½d.

MISCELLANEOUS EXAMPLES.

1. What is the simple interest on £760 for 5 months at $3\frac{1}{2}$ per cent.?

2. If £947 17s. gain £47 7s. 9d. in 12 months, in what time will £247·35 gain an equal sum?

3. Find the price of 6716 yards at $13\frac{7}{16}$ d. per yard, and of 5430 yards at $6\frac{3}{4}$ d. per yard.

4. Divide £18 7s. 3d. by $27\frac{3}{4}$; and add ·0623 to the difference between $\frac{4}{5}$ and $\frac{1\frac{2}{3}}{1\frac{1}{4}}$.

5. Simplify $\frac{2\frac{1}{5} + 1\frac{1}{3}}{2\frac{1}{2} - 1\frac{1}{3}} \times \frac{1\frac{7}{8} - 1}{\frac{1}{4} + \frac{2}{3}}$

6. When the 3 per cents. are at $96\frac{7}{8}$, and the $3\frac{1}{4}$ per cents. at 106, which of the two kinds of stock would a purchaser be likely to invest in?

7. Find the cube root of $181\frac{7}{8}$; and the square root of 593750689.

8. A trader borrows his capital at 6 per cent., payable yearly, and his profits are $6\frac{1}{2}$ per cent., quarterly; how much does he borrow (reckoning simple interest) when his annual gain is £450?

9. What principal being put to interest at $4\frac{5}{8}$ per cent. per annum, will, in 3 yrs. 11 mo., produce £15 10s. $6\frac{3}{4}$ ·168d.?

10. If a merchant insure his warehouse and goods to the amount of £7,500, at £2 17s. 6d. per cent., inclusive of duty, what annual premium will he have to pay?

11. If a piece of cloth is 20 yards long and $\frac{3}{4}$ yard broad, how broad is another piece of cloth which is 12 yards long, and contains as much as the first?

12. A shopkeeper buys writing desks at 26s. each; at what rate must he sell them again so as to gain $12\frac{1}{2}$ per cent., and allow the purchaser $2\frac{1}{2}$ per cent. discount?

13. A grocer sells a quantity of sugar for £22 10s., and by so doing loses 15 per cent.; what per centage would he have lost or gained had he sold the sugar for £27?

14. Find the sum of ·5 of 6s. 8d., and $1\cdot27$ of a guinea; and the difference between ·037 of 27s. and ·02 of £2.

15. Simplify and reduce to a vulgar fraction:—

$$\frac{2\cdot3}{1\cdot7} \times \frac{13\cdot85}{1\cdot02} \times \frac{1\cdot21}{4\cdot9}$$

16. A person sells out of the $3\frac{1}{2}$ per cents. at $93\frac{1}{2}$, and realises £18,700. If he invest one-fifth of this sum in the 4 per cents. at 96, and the remainder in the 3 per cents. at 90, find the alteration in his income.

17. An iron beam, 16ft. long, 2½ft. broad, and 8in. thick, weighs 1280 lbs.; what must be the length of a beam whose breadth is 3½ft., thickness 7½in., and weight 2028 lbs. ?

18. Extract the cube root of 343147021001; and the square root of .000003418801.

19. In exchange for 8 cwt. 2 qrs. 21 lbs. of tallow, worth 42s. per cwt., I received 10 lbs. of tea, worth 4s. 9d. per lb., and the remainder in money. How much money did I receive?

20. Find the difference between 3·4653 of a guinea and $\frac{9}{11}$ of £5.

21. If 7 men can do a piece of work in 11½ days, in what time will 8 men and 7 boys do the same, reckoning a boy's labour worth $\frac{2}{3}$ that of a man?

22. Simplify $\frac{\sqrt{1 + \frac{1}{3}} \div \sqrt{1 - \frac{1}{3}}}{\sqrt{1 + \frac{1}{3}} \times \sqrt{1 - \frac{1}{3}}}$

23. What fraction of £2 15s. is £2 14s. 9d. ?

24. In what time will £987 12s. amount to £1,197 9s. 3½d. at 4½ per cent., simple interest?

25. Find the present worth of £500, one-half of which is due in four months and the remainder in six months, discount at 5½ per cent. per annum.

26. Goods are purchased at £28 10s. 6d. per cwt.; the trade profits are 15 per cent. on invested capital; the income tax due thereon, at 9d. in the pound, amounts to £24 3s. 6d.; how many cwts. were purchased?

27. I have £2,400 in the 3 per cents., and sell out at 90½. With the money I purchase railway debentures at 111, and these debentures pay 5½ per cent. per annum. What is the difference in my annual income?

28. A and B exchange goods; A gives B 15 cwt. of hops, the retail price of which is 58s. per cwt., but he reckons them at £3 3s. per cwt.; B gives A 12 barrels of beer, of the retail value of 1s. 2d. per gallon, but the value of which he raises in proportion to the increased value of the hops. How much money must be paid, and by whom.

29. Simplify the expression—

$$\frac{4\frac{1}{2} - 3\frac{1}{3} + 5\frac{1}{6}}{7\frac{1}{2} - 4\frac{1}{3} + 11\frac{1}{6}} - \frac{11\frac{2}{3} - 5\frac{7}{6}}{11\frac{2}{3} + 5\frac{7}{6}}$$

30. In selling an article for 50 guineas I lost at the rate of 5½ per cent.; what ought I to have sold it for so as to have realised a profit of 7½ per cent. ?

31. Extract the cube root of 1,320, and divide $\cdot 001$ by 80,000.

32. A merchant begins a ready money business with a borrowed capital of £10,000, for which he pays 5 per cent. per annum. He turns over his capital twice a year, and his profits are 6 per cent. Allowing him 2 per cent., and the interest on his profits for expenses, how soon will he have paid off the debt?

33. A, B, and C have a capital respectively of £3,600, £4,500, and £18,000, on which they are receiving interest—A 10 per cent, B 8 per cent., and C 5 per cent. They agree to embark their joint capital in a speculation, on condition that the profits shall be divided in the ratio of their present incomes. A profit of 20 per cent. is made by the speculation. Find the share of each, and the rate per cent. actually received on their respective capitals.

34. Divide $\sqrt{2\frac{1}{2}}$ by $\sqrt{3\frac{1}{3}}$, and multiply $\frac{2\frac{3}{4}}{4\frac{2}{3}}$ by $\frac{2\frac{1}{4}}{13\frac{1}{3}}$.

35. £15,000 worth of railway shares were purchased at a premium of 50 per cent., and in selling them a loss of £7550 was sustained. Find the selling price per cent.

36. If a merchant's profit is $1\frac{1}{2}$ d. in the shilling, what is that per cent., and to what extent must he deal to gain £450 per annum?

37. Extract the square root (to 4 places of decimals) of $15\cdot\bar{3}$ and $6\cdot249$.

38. Simplify $\frac{5\cdot625 \div \frac{3}{4}}{(3\frac{1}{2} \times \frac{1}{4}\frac{2}{3}) \div 10\frac{1}{2}} \times \frac{3}{4}$ of $\frac{1\frac{1}{2} \text{ of } 4\cdot1}{13\cdot875 \times 5\bar{3}}$

39. What will it cost to carpet a room $24\frac{1}{2}$ ft. long by $15\frac{1}{2}$ ft. broad, the carpet being 4s. 6d. per yard, and $1\frac{1}{2}$ ft. wide, and allowing $4\frac{1}{2}$ ft. by $2\frac{1}{2}$ ft. for the fireplace?

40. The simple interest on £750 for $4\frac{1}{2}$ years being £165, in what time will the interest on £640 amount to £112 10s.?

41. A train starts from Liverpool to Manchester ($31\frac{1}{2}$ miles), and runs at the rate of 24 miles an hour; and another train starts at the same time from Manchester to Liverpool, running 18 miles an hour. At what distance from Manchester will the two trains meet?

42. I invested £1,200 in railway shares, purchasing at $20\frac{3}{4}$ per cent. discount. In selling I cleared £340 10s. At what price per cent. did I sell the shares?

43. There are three triangular stones, of which the solid

contents are 10,000, 16,656, and 20,000 solid inches respectively; what must be the side of a cubical stone to contain as much as the whole three;

44. A kitchen garden is 109 ft. 6 in. long, 58 ft. 6 in. broad, and cost £14 1s. 8d. digging, planting, and manuring; what was the cost per square yard?

45. Multiply $\cdot 4$, $\cdot 4$, and $\cdot 0004$ together.

46. If 3 per cent. stock is at $92\frac{1}{2}$, how much must be invested to secure an income of £46 10s. a year?

47. On the 1st of January I owe my stationer four sums, viz., £120, payable February 3rd; £35, payable March 17th; £100, payable May 5th; and £85, payable August 18th; I wish to pay in one sum; on what day shall the payment be made?

48. A quantity of tea is purchased in bond for £100, being at the rate of 2s. $2\frac{1}{2}$ d. per lb.; what will the duty amount to at 2s. $2\frac{1}{2}$ d. per lb.?

49. What is the cube root of 5591999266292267943659?

50. When 5 per cent. stock sells for £103 $\frac{1}{2}$, what percentage does a purchaser get for his money?

51. How much brass, at 1s. 3d. per lb., ought to be given for 98600 nails at $6\frac{1}{2}$ d. per hundred?

52. 150 gallons of gin were purchased for £66 13s. 4d., and retailed at 12s. 6d. per gallon; did the transaction result in gain or loss, and how much per cent.?

53. If my expenses per cent. be £7 10s. premium, 5s. policy, 25s. brokerage, and 27s. incidentals, what sum ought I to insure for to cover all the expenses, and the value of a property worth £20,000?

54. If a post be 5 ft. above water, $\frac{3}{4}$ of its whole length in the water, and $\frac{2}{5}$ in the mud, how long is it?

55. A cistern, containing 60 gallons of water, has 3 unequal cocks for discharging it; the greatest cock will empty it in 1 hour, the second in 2 hours, and the third in 3 hours; in what time will it be emptied if they all run together?

56. A shepherd being asked how many sheep he had, replied that $\frac{3}{4}$ of $\frac{1}{4}$ part of them were 18; how many sheep had he?

57. What is the radius of the largest circle which can be put within a square whose area is 734449 in.

58. Which is the cheapest, a hat which cost 15s. and will last 9 months, or one which cost 12s. and will last 7

months; and how much will a man save in 20 years who wears the cheaper kind of hat, interest not being reckoned.

59. If A possess $\frac{1}{4}$ part of a ship whose value is £6800, and B $\frac{1}{5}$ of the remainder, what should the third partner C pay them for their joint shares to make a profit of 10 per cent. by his purchase?

60. Divide $\frac{78\frac{4}{5}}{157\frac{1}{2}}$ by $\frac{29\frac{7}{17}}{71\frac{8}{11}}$.

61. Add together all the numbers from 1 to 300 that end in 9.

62. If 56 cubic feet 1,044 inches of timber are required to floor a room 29ft. 3in by 25ft. 4in., what is the thickness of the boards?

63. What annual income would enable a person to expend 4s. 6d. per day, and save £2 6s. 10 $\frac{1}{2}$ d. per month?

64. A person sells out of the 3 per cent. consols at 99, and invests in exchequer bills, bearing interest at the rate of 2 $\frac{1}{2}$ d. a day per cent. when the bills are at a premium of 7s. 6d.; what effect has this on his income?

65. A person mixed 8 lbs. of tea at 3s. 6d., 10 lbs. at 3s. 8d., 12 lbs. at 4s. 2d., and 10 lbs. at 4s. 6d., and sold the mixture at 4s. 8d. per lb.; what did he gain out of the whole quantity?

66. The shares of a given railway are at 44 $\frac{1}{2}$ when consols are at 70 $\frac{1}{2}$; what should be their price when consols are at 68 $\frac{3}{4}$?

67. There are two mountains, such that if 126ft. are added to 4 times the height of the lower one, the sum is half the difference between their heights. Given that the lower one is 441ft. high, find the height of the other.

68. Simplify the expression $\frac{\frac{1}{3} \text{ of } \frac{4}{5} \div 2\frac{2}{3} + 2\frac{1}{2}}{\frac{1}{7} \text{ of } \frac{2}{3} + \frac{1}{2} \div \frac{4}{5} - \frac{2}{3}}$

69. What fraction of a sovereign is $4\frac{1}{4} - 10\frac{1}{3} + 9\frac{2}{5} - \frac{1}{11}$ of a penny?

70. The rate of a clock is .04 per cent. too fast; how much will it gain in a day?

71. What is the length of a room, 6 $\frac{2}{3}$ ft. wide and 7 $\frac{1}{2}$ ft. high, which will exactly contain 12 boxes 4 $\frac{1}{2}$ ft. long 3 $\frac{1}{2}$ ft. wide, and 2 $\frac{1}{2}$ ft. deep?

72. A ship is worth £16,000, and a person possessed of $\frac{1}{5}$ of it sells $\frac{2}{3}$ of his share; what has he remaining, and what is it worth?

73. Express in figures eight trillions nine hundred millions and four; and in writing, 85678432164138975643126418.

74. What is the present worth of an annuity of £324, to

be paid for 12 years, 5 per cent. compound interest being allowed ?

75. A servant's wages are 22 guineas a year ; he enters his situation on the 12th of July, and leaves on Christmas Day in the same year. His master has advanced him $3\frac{1}{2}$ guineas ; what sum ought he to receive on leaving ?

76. Two men bought an ox weighing 5 cwt. 2 qrs. 20 lbs., and sold it at $7\frac{1}{2}$ d. per lb. ; what is each man's share of the selling price, one having given half-a-crown for every two shillings of the other in the purchase money ?

77. If a pin is worth the $\frac{1}{72}$ nd part of a penny, what is the value of a book of 100 leaves, at a pin the first leaf, two for the second, and doubling the number for each leaf ?

78. If a person invest £1,200 in 3 per cent. consols, when the price is $88\frac{1}{2}$, what income will he derive, and what interest will he have for his money ?

79. How long will it require to count eight hundred millions, at the rate of 250 a minute, reckoning ten hours to a day ?

80. The reversion of an annuity of £175 per annum, to continue 11 years, and commence 9 years hence, is to be sold ; what is its present worth, allowing 6 per cent. per annum compound interest ?

81. If the net income of an estate, after paying all taxes, be £2,710 6s. 3d., and the gross income be 3,000 guineas, how much in the pound did the taxes amount to ?

83. A fixed rent of £1,170 per annum is converted into a corn-rent of one half wheat, at the average price of 48s. per quarter, and the other half barley, at the average price of 30s. per quarter ; what will be the rent when wheat has advanced to 56s., and barley to 32s. per quarter ?

84. A coach goes 9 miles in an hour, and a railway train goes 23 miles while the coach goes 11 ; how much time will be saved in a journey of 138 miles by taking the train instead of the coach ?

84. A farmer has four sorts of wheat worth 5s., 6s., 7s., and 7s. 6d. per bushel respectively ; how much of each sort must he take to make 64 bushels worth 6s. 6d. per bushel ?

85. If 17 guineas be lost by the sale of 460 lbs. of raw silk at £1 6s. 4d. per lb., what was the prime cost per lb. ? What is the loss per cent. ?

86. A father left amongst his three sons, whose ages were respectively 13, 17, and 20, a farm containing 231 acres 2 roods 10 perches, and directed that each son's

share should be in proportion to his years ; what was each share ?

87. There are 5 mills ; the first grinds 7 bushels of corn in 1 hour, the second 5 in the same time, the third 4, the fourth 3, and the fifth 1 ; in what time will the 5 grind 500 bushels, if they all work together ?

88. A person increased his capital annually $\frac{1}{3}$ th part, and at the end of 3 years, one year's interest thereon at $3\frac{1}{2}$ per cent. amounted to £162 ; what capital did he start with ?

89. What would be the charge for fuel for 800 men for 12 months, provided the ration for each man per diem consisted of $1\frac{1}{3}$ ft. of wood, from 1st May to 31st October, and half that quantity for the remainder of the year, the price of fuel being 6 $\frac{1}{2}$ d. per foot ?

90. What part of £5 9s. is £4 13s. 5 $\frac{1}{2}$ d. ?

91. Bring $(\frac{1}{3} + \frac{2}{3})\text{£} + (\frac{1}{3} + \frac{2}{3})\text{s.} + (\frac{1}{4} + \frac{3}{4})\text{d.}$ to the decimal of £1.

92. A merchant consigns to his factor in Jamaica 32 bales of cloth, with orders to dispose of it at £172 5s. 10d. per bale, and after retaining commission at 6 per cent., to make remittance for value, one-half in sugar at £2 10s. per cwt., and the other half in rum at 13s. 6d. per gallon ; what quantity of rum and sugar must be returned by the factor ?

93. If 5 men and 3 boys can perform a work in 35 days of 12 hours each, in how many days of 10 hours each can 16 men perform a work which is greater by one-half, the work of 3 men being equal to that of 7 boys ?

94. A and B go out of town by the same road ; A goes 8 miles each day ; B goes 1 mile the first day, 2 the second, 3 the third, &c. ; when will B overtake A ?

95. The minute hand of St. Paul's clock is 8ft. long ; what number of miles does the end of it travel through in one year ?

96. A merchant has a quantity of coffee weighing 7,800 lbs., at 1s. 3 $\frac{1}{2}$ d. per lb., which he barter for equal quantities of sugar at 7 $\frac{1}{2}$ d. per lb., and tea at 4s. 9d. per lb. ; how many pounds of each will he receive ?

97. A can do a piece of work in 12 hours, B in 4 hours, and C in 3 hours. A, B, and C, all work together for half an hour, when A leaves off ; how long will it take B and C to finish the piece of work ?

98. What number is that, from which if you deduct the 25th part of 22,525, and to the remainder add the 16th part of 9,696, the sum will be 1,440 ?

99. Reduce £125 10s. into francs and centimes, exchanged at 23 francs 6 centimes per £.

100. A ship cost 2,000 guineas ; what part of her can be purchased for £1,312 10s. ?

101. A farmer hires two labourers ; to the one he gives 9d. a day, to the other 2d. the first day, 4d. the second day, 6d. the third day, &c. ; in how many days will they earn an equal sum ?

102. The driving wheel of a locomotive is 6ft. in diameter ; how many revolutions does it make per minute if the train travels at the rate of 30 miles an hour ?

103. Four men received a prize in time of war valued at £8,190 ; but being of different ranks, it was divided as follows : the first received $\frac{1}{2}$ of the whole and $\frac{1}{10}$ more ; the second $\frac{1}{4}$ of the whole and $\frac{1}{10}$ more ; the third $\frac{1}{8}$ of the whole. What part of the whole did the fourth receive, and what was the amount of each man's share ?

104. A young man received £210, which was two-thirds of his elder brother's portion ; and three times the elder brother's portion was half the father's estate ; what was the estate ?

105. If the present worth of £30,192, due 6 months hence, at 4 per cent. per annum, be invested in the 3 per cent. consols at 92 $\frac{1}{2}$, what will be the half-yearly dividend after deducting income tax at 1s. 4d. in the pound ?

106. What is the income corresponding to an income tax of £108 1s. 4 $\frac{1}{2}$ d. at the rate of 9d. in the pound ?

107. If 14 lbs. of butter are worth 10 stones of oats, 5 stones of oats = 3 $\frac{1}{2}$ stones of flour, 2 stones of flour = 10 stones of salt, and 15 stones of salt = 6 doz. of eggs, how many doz. of eggs are 7 lbs. of butter worth ?

108. How many years' purchase, in other words how many years' rental, should be paid for freehold property to clear 3 $\frac{1}{2}$ per cent. ?

109. There are two numbers which, when added together, make 30 ; but the $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{6}$, of the greater are equal to $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ of the lesser ; what are the numbers ?

110. A dishonest tradesman has a weight 1·24 oz. too light in the pound ; if he sold his goods at prime cost, what per cent. would he gain ?

111. An ellipse is surrounded by a wall 14 in. thick, its axes are 840 links and 612 links ; what quantity of ground is enclosed, and what quantity is occupied by the walls ?

112. A life is insured for £1,000 at a yearly premium of

£60, and the insurer dies immediately after paying his fifth annual premium; how much does the company lose by the transaction, reckoning at 5 per cent. compound interest?

113. How many grains of oxygen are there in a cubic foot of air, calculating on the following data?—The oxygen of atmospheric air is 3 in 14 parts of the whole, 100 cubic inches of air weigh 31 grains, and the weight of oxygen is to that of air, bulk for bulk, as 53 : 48.

114. Two ships sail from the same port on the same day; the one sails due north 28 miles a day, the other due west 36 miles a day; how far are they apart after sailing six days?

115. If £90 lent for a year is repaid, with interest, by £95 8s., what rate per cent. was charged?

116. The contents of two cubes are respectively 5359·375, and 5·359375 cubic feet; how many inches difference is there in the length of their edges?

117. If 7 lbs. of beef be worth 8 lbs. of pork, 9 lbs. of pork = 7 lbs. of bacon, 20 lbs. of bacon = 18 lbs. of mutton, and 12 lbs. of mutton = 10 lbs. of cheese; how many lbs. of cheese are equal to 8 lbs. of beef?

118. Four persons hold a pasture farm in common, for which they are to pay £80 17s., and into which A puts 8 cows for three months, B 9 cows for 4 months, C 16 cows for 3 months, and D 13 cows for three months; how much of the rent should each pay?

119. If £1,500 be borrowed for 2 years at $4\frac{1}{2}$ per cent. simple interest, and lent at 5 per cent. compound interest for the same period, how much is gained by the transaction?

120. A father being asked by his son how old he was, replied, your age is now $\frac{1}{2}$ of mine, but four years ago it was only $\frac{1}{3}$ of what mine is now; what is the age of each?

121. The diameter of a standard bushel is $18\frac{1}{2}$ in., and its depth 8 in.; what must be the diameter of that bushel which is $7\frac{1}{2}$ in. deep?

122. Find the difference between the interest and discount on £370 15s. for 9 months at 4 per cent.

123. A mixture of 15 cwts. 0 qrs. 15 lbs. of guano is made up of 1 cwt. 2 qrs. 15 lbs. of No. 1 quality, 3 cwts. 1 qr. 7 lbs. of No. 2, and 10 cwts. 0 qrs. and 21 lbs. of No. 3; find how much per cent. of the whole No. 1, No. 2, and No. 3 is respectively?

124. What is the difference between the simple interest

and discount of a bill for £1,000 drawn at nine months, at $3\frac{1}{2}$ per cent.?

125. A merchant insures a cargo whose value is £4,500 at 5 per cent.; for what sum should he insure so as to cover both the loss of the cargo and premium?

126. What sum payable one year hence will be equivalent to £200 due now, and £600 due at the end of two years, the rate of interest being 5 per cent.?

127. A number of men were arranged into a hollow square 4 deep. In the outer rank there were 50 in the face of the square, and in the inner rank 44; how many men were there in all?

128. At what time between 3 and 4 o'clock will the hands of a clock be together?

129. The par of exchange is $17\frac{9}{16}$ d. Flemish, but the course of exchange is $18\frac{3}{4}$ d.; what is the gain per cent.?

130. Having melted together 7 oz. of gold, 22 carats fine, $12\frac{1}{2}$ oz. 21 carats fine, and 17 oz. 19 carats fine. I wish to know the fineness of an ounce of the mixture.

131. What is the number corresponding to the logarithm 11.991687?

132. Raise 0.000007 to the 12th power.

133. Find the value of $\sqrt[9]{10077696}$.

134. One extreme is $4\frac{3}{8}$, the other 143, the number of terms 42; what is the sum?

135. In an arithmetical series the common difference is $\frac{5}{6}$, and the extremes are $14\frac{2}{3}$ and 11; what is the number of terms?

136. The extremes of a geometrical series are 12 and 175692, and the common ratio 11; what is the sum?

137. Find 8 geometrical means between 4096 and 8.

138. What will be the price of a horse sold for one farthing for the first nail in his shoes, two for the second, four for the third, &c., allowing 8 nails in each shoe?

139. There is a cistern which can be filled by a cock in 12 hours; it has another cock in the bottom by which it can be emptied in 18 hours; in what time will it be filled if both are left open?

140. A vintner has a vessel of wine containing 500 gallons; drawing 50 gallons off, he then fills up the cask with water; after doing this five times, how much wine and how much water are in the cask?

141. A certain number of horse and foot soldiers are to be ferried over a river, and they agree to pay $2\frac{1}{2}$ d. for two horse, and $3\frac{1}{2}$ d. for seven foot soldiers; seven foot always

followed two horse soldiers, and, when they were over, the ferryman received £25; how many horse and foot soldiers were there?

142. If the French 3 per cents. are at 60 when the English are at 95, the exchange between the countries being 25 francs to the pound, how much French stock in francs can be bought by selling £6,000 stock out of the English funds?

143. If 24 navvies in $2\frac{1}{2}$ days of $12\frac{1}{2}$ hours long can dig a trench 139·75 yards long, $4\frac{1}{2}$ yards wide, and $2\frac{1}{2}$ yards deep, how many hours per day must 180 navvies work during 21 days, in order to dig a trench $4910\frac{1}{10}$ yards long, $4\frac{1}{2}$ yards wide, and $3\frac{1}{2}$ yards deep?

144. Simplify the following expression:—

$$10\frac{9}{13} \times \left(7\frac{1}{2} + \frac{\frac{23}{2} - \frac{12}{5}}{\frac{23}{2} + \frac{12}{5}} \right) - 7\frac{1}{8}$$

145. A grocer buys 3 cwts. of sugar at 5d. per lb., and 7 cwts. at $6\frac{1}{2}$ d.; he sells $5\frac{1}{2}$ cwts. at $5\frac{1}{2}$ d. per lb.; at what rate per lb. must he sell the remainder in order to make 50 per cent. on his whole outlay?

146. If a man row 14 miles in $3\frac{1}{2}$ hours against the stream, the rate of which is 6 miles an hour, in what time should he row 10 miles with the stream?

147. Insert 9 arithmetical means between 3 and 9, and extract the cube root of 127·263527.

148. Reduce ·126d. to the decimal of £1, and 864 square feet to the decimal of an acre.

149. The capital of a manufacturing firm is £600,000, and the working expenses amount to £30,000 a year. What must be the gross profits to pay the company 8 per cent. upon the capital?

150. The number of paupers in a certain union was 336, the number of women being double that of the men, and the children being as many as the men and women together. If a man cost one-third more than a woman, and three children as much as a man and a woman together, and the whole cost for the month (December) be £83 6s., what is the daily cost of each man, woman, and child?

151. The expense attending the production of a book, the retail price of which is 7s. 6d., is 2s. $4\frac{1}{2}$ d. per copy. The publisher allows the bookseller 25 per cent. on the retail price, and gives 13 copies to the dozen. 3,000 copies are printed and sold, and the author is to have half the profits. How much will he receive?

152. Simplify—

$$\left(\frac{3.5 - 1.83}{4.1 + 5.8} \times \frac{7.25 \times 1.2}{3.25} \right) + \frac{3.1 \times .101}{2.15}$$

153. Three persons, whose estates are worth respectively £1000, £755, and £645 a year, buy 100 railway shares among them, each buying a number proportional to his estate. How many shares does each buy?

154. If 12 oxen be worth 29 sheep, 15 sheep worth 25 hogs, 17 hogs worth 3 loads of wheat, and 8 loads of wheat worth 13 loads of barley; how many loads of barley must be given for 20 oxen?

155. Add together the cube roots of .059319 and 4.173281, and multiply the sum by the square root of $105\frac{1}{16}$.

156. Simplify the expression—

$$\frac{4\frac{1}{2} - 3\frac{1}{3} + 5\frac{1}{12}}{7\frac{1}{2} - 4\frac{1}{3} + 11\frac{1}{12}} - \frac{11\frac{3}{4} - 5\frac{7}{15}}{11\frac{3}{4} + 5\frac{7}{15}}$$

157. If 248 men, in $5\frac{1}{2}$ days of 11 hours each, dig a trench $232\frac{1}{2}$ yards long, $3\frac{1}{2}$ yards wide, and $2\frac{1}{2}$ yards deep, in how many days of 9 hours each will 24 men dig a trench $337\frac{1}{2}$ yards long, $5\frac{1}{2}$ yards wide, and $3\frac{1}{2}$ yards deep, supposing that the same number of men in the same time would be $1\frac{1}{2}$ as long digging the first as they would be in digging a trench of equal dimensions of the nature of the second?

158. A triangular field 738 links long, and 583 links in the perpendicular, produces an income of £12 a year. At how much per acre is it let?

159. A ship's hold is 102 ft. long, 40 ft. broad, and 5 ft. deep; how many bales of goods, each 3 ft. 6 in. long, 2 ft. 3 in. broad, and 2 ft. 6 in. deep, can be stowed into it, leaving a gangway of 4 ft. broad?

160. Simplify the following—

$$\left(\frac{3.5 - 1.83}{4.1 + 5.8} \text{ of } \frac{7.25 \text{ of } 1.2}{3.25} \right) + \frac{3.1 \text{ of } .101}{2.15}$$

161. Suppose the population of a country would increase annually by 3 per cent., were it not for emigration, which annually carries off .5 per cent. of the people; what will be the increase per cent. in the population after 5 years?

162. A farmer sows a field of 7 acres with wheat, oats, and barley; the areas of the crops being respectively as $1\frac{1}{2} : 1\frac{1}{3} : 1\frac{1}{4}$. If the values of an acre of each be also respectively in the same ratios, and an acre of wheat be worth £7, what is the worth of the whole crop?

163. If a cubic foot of gold may be made in gilding to

cover 402,600,000 square inches, find the thickness of the coating of gold?

164. In the London General Post the proportion of unpaid letters to the whole number posted was 8 per cent.; and of the paid letters 51 per cent. were stamped; the whole number posted was 450,000; how many of them were stamped?

165. What is the value of a perpetual annuity of £46, allowing 5 per cent. interest?

166. What is the 5th root of 483672?

167. A person passed $\frac{1}{6}$ of his age in childhood, $\frac{1}{4}$ of it in youth, $\frac{1}{3}$ of it + 5 years in matrimony; he had then a son whom he survived 4 years, and who reached only $\frac{1}{2}$ the age of his father; at what age did this person die?

168. Find the sum of the series $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$, &c.

169. There is a number $\frac{1}{2}$ of which being divided by 6, $\frac{1}{3}$ of it by 4, and $\frac{1}{4}$ of it by 3, each quotient will be 9; what is the number?

170. A market woman bought a certain number of eggs at two a penny, and as many more at 3 a penny, and having sold them all at the rate of 5 for 2d., she found she had lost 4d; how many eggs did she buy?

171. What number is it which divided by 16 will leave 3, but which, divided by 9, will leave 4?

172. Find the 6th term of the geometrical series 3, $\frac{1}{2}$, $\frac{1}{4}$, &c.

173. Express the common numbers 34705 and 790158 in the septenary scale, and the denary number 5381 in the ternary and nonary scales.

174. A, B, and C, enter into partnership and contribute, respectively, the sums of £438, £292, and £730, with the agreement that each was to receive 5 per cent. on their respective investments, and that the remainder of the gains of the firm, if any, was to be divided between them in the proportion of the sums originally advanced. The whole gain of the firm was £200; what was each man's share?

175. Express $\cdot 20012\bar{3}$ as a vulgar fraction, and express as a circulate $\cdot 012 \div \cdot 00132$.

176. Reduce to its simplest form;—

$$\frac{2\frac{1}{4} - \frac{2}{3} \times 1\frac{5}{6}}{\frac{1}{5} \times 3\frac{1}{3} + \frac{1}{3}\frac{2}{3}}$$

177. A shopkeeper buys fine biscuit flour at £1 4s. per cwt. At what price per cwt. must he sell it in order to gain $12\frac{1}{2}$ per cent., and allow the purchaser 10 months' credit?

178. A person owes £750, which was to be paid thus:—£250 at the end of 18 months, £100 at the end of 2 years, and the remainder at the end of 4 years. Find the time at which the whole may be paid at once?

179. A merchant bought a quantity of cotton, by the sale of which, had he gained 4d. per lb., the amount would have been £34 7s. 6d.; but having been compelled to sell it at a loss of 2d. per lb., he received only £28 2s. 6d. Find the quantity.

180. A gentleman finding several beggars at his door, gave to each 4d. and had 6d. left, but if he had given 6d. to each he would have had 12d. too little; how many beggars were there?

181. What is the amount of £49 per annum unpaid for 7 years, 6 per cent. compound interest being allowed?

182. What debt can be discharged in a year by monthly payments in geometrical progression, the first term being £1, and the last £2048; and what will be the common ratio?

183. Find the value of $\sqrt[6]{0.000000004096}$.

184. Raise $\frac{3}{4}$ to the 8th power.

185. Find the logarithm of $\frac{1394}{818416}$.

186. A grocer has sugar at 5d., 7d., 12d., and 13d. per lb.; how much of each kind will form a mixture worth 10d. per lb.?

187. Reduce £437 British to Canadian currency at 78 per cent.

188. Reduce 30000 piastres to British money at 40d. per piastre.

189. A bill is drawn for £486 18s. 8d., March 25th, at 10 months, and discounted on the 19th June; what is it then worth, allowing 5 per cent. per annum discount?

190. A gentleman, by will, leaves £4000 to an hospital, and the residue of his property between 3 persons, A, B, and C, in the proportion of the numbers 3, 5, and 7; C's share of the property is £6,300; what did the gentleman die worth?

TABLES OF FOREIGN MONEY

IN WHICH ACCOUNTS ARE KEPT.

Austria, Munich, and Baden.

4 Pfennings = 1 Kreutzer
60 Kreutzers = 1 Florin

Bremen.

5 Schwaren = 1 Grot
72 Grots = 1 Thaler Louis
d'or

*British North America and
the United States.*

100 Cents = 1 Dollar

China.

720 Taels of Account = 1,000
Dollars
717 Taels in exchange weigh
1,000 Dollars.

Denmark.

16 Skillings = 1 Mark
6 Marks = 1 Rigsbank Dollar

*France, Belgium, and
Switzerland.*

100 Centimes = 1 Franc

Frankfort on the Main.

4 Kreutzers = 1 Batzen
15 Batzen = 1 Florin .

Greece.

100 Lepta = 1 Drachma

Hamburg.

12 Pfennings = 1 Schilling
16 Schillings = 1 Mark banco

Holland.

100 Cents = 1 Florin

East Indies.

12 Pice = 1 Anna
16 Annas = 1 Rupee

Italy.

100 Centesimi = 1 Lira

Portugal.

1,000 Reis = 1 Milreis

Prussia.

12 Pfennings = 1 Silber
Groschen
30 Silber Groschen = 1 Thaler

Russia.

100 Copecs = 1 Rouble

Spain.

8 Reals, Plate = 1 Dollar,
Plate

Sweden.

48 Skillings = 1 Rixdollar,
banco

Turkey and Egypt.

40 Paras = 1 Piastre

THE NEW APOTHECARIES' WEIGHT.

(By Act of Parliament, 1858.)

437½ Grains, troy = 1 Ounce
16 Ounces = 1 Pound

